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Co-operation Between Local Societies

AN interesting example of how local societies can be of assistance to one another is afforded by a communication recently addressed by Horace H. Lane, president of the Detroit Engineering Society, to other local bodies in the Middle West, asking for information regarding good speakers and subjects for their programs. Local societies are frequently hard pressed to get suitable program material, but the difficulty would quickly disappear if the various bodies would co-operate. The speakers themselves will be glad to have a second and a third opportunity to present their subjects, while if a talk pleases one body it is poor economy to let it go unrepeated. Mr. Lane reports that the societies to which he has written have very kindly offered to co-operate. This is but one of many directions in which the local bodies can assist one another. It is just such inter-society relations which the Conference on Co-operation, of which Prof. F. H. Newell is chairman, is encouraging.

Latest Style in Highways

"THE road would be a quarter of a mile wide and would be a model highway, with a centerway for an automobile speedway and side roads for local traffic—straight for 100-mile stretches." In these words Miss Lillian Stuart of St. Louis described before the congress of the American Prison Association a 1000-mile highway from the Lakes to the Gulf, which is expected to be a "huge step in solving unemployment, poverty and crime." We have given improved highways credit for many things, but this road is to be a panacea for all social ills. But what less could one expect from a highway one-quarter of a mile wide and straight for 100-mile stretches?

High-Price Men in Demand

YOUNG ENGINEERS with ambition for the future, and older engineers who may be dissatisfied with the salaries they now receive, should ponder the meaning of an advertisement which appeared in last week's issue. Two men, each at $7,500 per year, one for superintendent of plant and one to design and construct a new plant, both with experience in mechanical and steam engineering, are desired by a firm of engineers in New York City. In addition to salary the men will be given a share in the profits of the company. They must have had continuous employment with at least one reliable company for over three years at a salary of $5,000. That such an advertisement should appear is proof positive that high-priced men are not only in demand, but are difficult to find. The advertisers undoubtedly canvassed their acquaintances thoroughly beforehand. The incident emphasizes the statement so often made to young men regarding the rewards which await those who can master the technical details of their work and then acquire that knowledge of human nature which marks the successful executive.

Fire Menace in Bridge Floors

ANOTHER expensive demonstration of the serious hazard to steel bridges with improperly protected timber-floor systems was witnessed in the fire of the St. Charels highway bridge over the Missouri River, reported in the last two issues. These fires, often started by sparks from locomotives operating on tracks below the structure, the reported cause in this case, are of periodic occurrence. The magnitude of the losses in such cases as this, where long-span trusses have been buckled by the heat and require rebuilding, again raises the question discussed editorially in the issue of May 15, 1915: Are designing engineers valuating properly the fire hazard when unprotected combustible floors are used? It is doubtful whether the percentage decrease in cost of expensive spans is large enough to justify the adoption of all-wooden instead of solid floors, with wood-block, asphalt or other surfacing. In the absence of fireproofing to protect the structure it is evident that a very high insurance rate could properly be charged against the cheaper construction. Disaster is certainly invited by exposed timber, whether creosoted or not, combined with the probability of high winds in river valleys.

Saving New York—The Next Step

SPACE has been given in these columns on two occasions to the movement in New York for securing the removal of factories from the theater, hotel and the shopping district. As was set forth in the Engineering Record of August 5, the campaign has been remarkably successful. Of the 220 manufacturers in the district bounded by Thirty-third and Fifty-ninth streets, Third and Seventh avenues, 202 have agreed to move as soon as their leases expire. The committee in charge of the movement having accomplished its main object is now busy on a complementary task—that of securing for the restricted zone the proper class of tenants. There will be much space available when the factories move out. Naturally the landowners will incur a considerable loss if the property remains idle. The committee is therefore pointing out to the business men of New York the opportunity that will exist for securing good quarters in this very convenient and desirable portion of the city. Attention is called to the subject here because a great many other cities have displayed an interest in this radical city-planning expedient. If other cities, unable to handle the situation by legal enactment—and that was the case at New York—adopt similar methods, they should realize that in addition to securing the removal of undesirable classes of tenants they should take steps to replace these by a class of occupants that will be in harmony with the character of the district in question.

Selling Lumber Honestly

PRESUMABLY the merit of branding lumber has by this time been proved to engineers, architects and contractors so conclusively that they are now demanding it in sufficient volume to make the retailers want their business. At any rate, a small number of retailers in the Middle West have seen the light with reference to branding and other methods of merchandising. They recently formed a national organization whose purpose is to combat dishonest practices in the way of mixing grades, giving short measure and misrepresenting the quality of lumber offered for sale, to discourage the practice of manufacturers selling direct to the consumer, and to support the branding practice which insures the integrity of the grade with consequent protection to the retail dealer and the consuming public. Whether the engineer, architect or contractor is responsible for this awakening because of his insistence on getting branded timbers and in buying direct from the manufacturer when he could not get it from local yards is of little moment. The fact remains that hereafter at least a small group of retailers making up the National Retail Lumber Dealers' Association will be likely to carry branded lumber showing the kind, grade and manufacturer in their yards. Gradually the lumber industry will get down to the same sound selling methods as are prevalent with other materials of construction.

A Ban on Juggernauts

IF present signs have been correctly interpreted New York City will soon have an ordinance regulating the weight, size, and speed of motor vehicles. Up to the present time no such instrument exists. That one is sorely needed was shown by the evidence of pavement damage presented by Eugene W. Stern, chief engineer of highways, Borough of Manhattan, in a paper delivered before the convention of the American Society of Municipal Improvements in Newark, N. J., last week (see page 495). In New York to-day a contractor's tractor-trailer outfit having steel tires and carrying a load of 15 tons—a veritable Juggernaut—has raised havoc with city pavements, but there is no legal way in which its owner may be taken to task. The pavements in this case were granite block and sheet asphalt, both on 6-in. concrete foundations and only four years old. Clearly a halt should be called on such unreasonable use of city streets. It is true that the trucks are operated on a work of public improvement—the construction of the new subway—but even this fact does not justify the damage that has been done.

The matter of regulating motor vehicles is one that can best be solved by co-operation between municipal authorities and manufacturers of trucks. In the case of New York it is understood that such co-operation is now well established. It is well that this is so, for the interests of the city and of the manufacturers themselves will thus be better served. Into the making of such an ordinance as the one proposed more than the mere weight of the vehicle must enter. There are the correlated factors of speed, overall dimensions of the vehicle—an important element in traffic congestion—diameter of wheels, width of tire, character of springs and material of tire, whether of rubber or steel.

In some localities in this country legislation controlling motor vehicles has been enacted, but Mr. Stern believes that the best work in this respect has been done in Europe. Not the least interesting part of his paper is the digest of such ordinances as are now in effect.

It is safe to predict that the general subject of motor-vehicle regulation will soon receive far more widespread attention than it has in the past. This will not mean any diminution of the use of motor trucks. They have demonstrated their value far too convincingly for any such result. It means merely a greater degree of team work between the builders and the users of our highways.

Condition of Long Steel Pipe Line in Australia

EVER since it was completed fourteen years ago, the 30-in. steel pipe line supplying the Goldfields area of Western Australia has occupied a position of unique engineering interest. It was a daring project—the delivery of water by a conduit and relays of pumping plants a total distance of 351½ miles across a semi-desert country. But the construction features alone, despite their boldness, were not the only objectives upon which attention has been focused. The pipe line, in many sections, was laid in soil containing soluble salts which, because of their highly corrosive properties, caused grave concern for the permanence of the exterior coating and the metal underneath it. The interior also was subject to attack by water having unusual corrosive properties.

It soon became evident that the maintenance of the steel pipe under these trying conditions would be as big a problem as the one of actual construction. In 1909 a board of experts investigated the condition of the steel and its protective coating (see Engineering Record of May 21, 1910, page 671) and, among other things, recommended that the water be deaërated and treated with lime to minimize its attack upon the interior of the conduit. As for the exterior damage, the board suggested new coatings and a layer of slaked lime. Since that time the pipe line has continued in service, and the latest authentic records of its condition are contained in the annual report for 1914-15 by P. V. O'Brien, the engineer in charge (see page 501).

The report tabulates the expenditures on maintenance since 1902, discusses both internal and external corrosion of the coating and the steel plates and considers the matter of repairs. For the next three or four years, Mr. O'Brien believes, it will not be necessary to resort to such extreme measures as removing any great number of pipes, but the progress of general corrosion on certain sections of the main and the thinning of many of the pipe ends are, he states, inevitably bringing the time nearer when these measures must be resorted to. As for the present, careful attention is required to minimize the corrosive quality of the water, presumably by the lime treatment practised in the past, and to watch the progress of corrosion in order to determine the economic time for relaying sections of the mains.

The Australian records should prove valuable to those who are interested in the service of steel pipe under extremely adverse conditions.

How Not to Run a Society Convention

THE CONDUCT of the annual convention of the American Society of Municipal Improvements in Newark last week sustains in full the arraignment of that organization's methods made by the Engineering Record in its editorials of Sept. 30, page 398, and Oct. 7, page 428. The first of these directed attention to the absurdity of a technical program of such interminable length as the one prepared. The second dealt with the scandalous practice of specification-making which the society has followed for years and which was shown up in all its viciousness at last week's meeting. As a result of the proceedings at the Newark convention there can be but one verdict: Guilty on both counts.

In another column the paving specification fiasco is discussed at length. The following comment will be confined to the lamentable exhibition of bungling in the handling of the technical session on sewage treatment—a session rich in possibilities under intelligent management.

The technical program was characterized by the Engineering Record as top-heavy, and its collapse was predicted. This journal was specific in objecting, not to the character of the papers—for many of unusual excellence were listed—but to the overwhelming number. These predictions were made: That adequate treatment of all the subjects listed would be impossible; that discussion from the floor—always the most interesting and valuable feature of conventions—would be curtailed; that authors who had taken the time and trouble to prepare papers would be summarily disposed of by the "reading-by-title" route; that engineers who, after personal sacrifice in time and money, had made the trip to Newark to present or to discuss papers would be doomed to disappointment. The result last week vindicated the forecast.

Due to the insufficiency of the time available for the sewage papers, the intrusion, at the outset, of a long paper on a topic entirely foreign to the avowed purpose of the session, and the necessity for quitting the room early to allow for banquet arrangements, the sewage-treatment meeting fell far short of expectations. Its possibilities were great, particularly as regards information on the activated-sludge process. The audience contained an array of sanitary-engineering talent such as seldom can be brought together. The stage was set for an important conference, yet there was no opportunity for discussion, and several important contributions had to be omitted or summarized so briefly that their effect was lost. It was a woeful exhibition of lack of foresight, all the more deplorable because the convention management permitted a manufacturer of a patented pavement—"standardized" by the society—to deliver, not one, but two addresses exploiting his product.

Apropos of the conduct of the sewage-treatment session the opening remarks of George A. Carpenter, chairman of the society's committee on sewerage and sanitation, are, by contrast, a sharp condemnation of what happened. He said, in part: "The committee wishes to emphasize the necessity of an intelligent discussion of the papers presented, arranged for in advance, if engineers of prominence are to be persuaded that it is worth their while to prepare papers for meetings of this character. Replying to the committee's invitation to prepare a paper upon certain experiments which were being carried out under his direction one engineer wrote, 'I find that it is not worth while spending the time which it takes to present such a paper unless some discussion is given to it, and unless men able to discuss such a subject are selected by your committee and have a copy of the paper in hand for the convention.'"

This is not the first time that the Engineering Record has had occasion to criticise the management of engineering conventions. A number of organizations that have expanded in membership during recent years are still trying to administer their affairs by the methods which proved satisfactory when the associations were small. The situation at Newark last week is almost precisely the same as that which developed at the New York convention of the American Waterworks Association early this summer, and which was commented upon editorially in the Engineering Record of June 17, page 789.

Both cases indicate forcibly that in the handling of convention programs there is need of a man who can sense the important things and give them due prominence. Any man with such characteristics would have been quick to feature the activated-sludge session at Newark last week and give it ample time—to the exclusion, it would be hoped, of some of the commercialized papers.

As election day draws near we hear a great deal about "business administrations." Why can we not have business administrations in the conduct of society conventions?

A Disgrace to the Engineering Profession

IN the issue of Oct. 7 the Engineering Record characterized the specification-making procedure of the American Society of Municipal Improvements as a reflection on the engineering profession. After attending the society's convention in Newark last week it is desired to amend the characterization and to say that the procedure was a *disgrace* to the profession. Throughout, the manufacturers occupied the foreground. One gained the impression that their interests were paramount, and that the public, regarding which the convention literature spoke so solicitously, was not a factor. Some may have doubted the justness of the Engineering Record's previous condemnation of the society, but there will be no doubt in the minds of those who were at Newark or who read the proceedings of that meeting, as described in the news columns of this issue, page 513. In fact, the society itself voiced dissatisfaction with its procedure by authorizing the appointment of a committee to revise the constitution, while from the floor on Thursday night two speakers, themselves in the thick of the mêlée, condemned proposed actions, saying that they were of the type that had brought criticism on the society from the engineering press.

The "battle of the materials" started on Monday morning before the subcommittee on specifications for creosoted wood-block paving. Following the usual custom the specifications were *not* issued to the membership in advance; the members were asked to consider a highly technical document and to give a decision instanter. Some few—those who had attended a private meeting in New York last month—were provided with copies of the tentative requirements. Of the sixteen or more men in the room during the hearing eleven represented manufacturers of creosoting material, while of the other five, only three were bona-fide city officials. The other two were consulting engineers, one of them much in the service of material manufacturers.

The session need not be described in detail here. It was a fight for "our interests," the only persons not material men participating in the discussion being the chairmen of the subcommittee and of the general specifications committee. When the subcommittee adjourned the air was filled with predictions as to the storm that would break loose in the convention if a water-gas tar alternative were not included in the specifications.

The climax came Thursday night, but strangely not in connection with the subject on which a fight had been predicted—the wood-block specifications. They came up Friday morning. The subcommittee reported a water-gas tar alternative. The warring interests were satisfied and the specifications went through without an objection.

The initial fight Thursday evening was precipitated by an amendment which proposed to substitute an alternative type of specification for the present blanket asphalt specifications. The resolution, apparently, was a surprise to the membership. They were asked, without an opportunity to criticise or study the alternative specifications offered, to reverse the society's Boston action.

The debate was stormy, discussion was shut off by the chair while a member was demanding the floor, and the question was so put that it was impossible to understand what was being voted on. The chair at first refused to give the count, although declaring against the amendment, and a demand for a recount, made by two members, went unheeded. Apparently this was the end, for the evening, of the asphalt specifications.

Next came the report of the subcommittee on bituminous pavements. It was a brief document and made no reference to the Bitulithic specification, which comes within the purview of the subcommittee. The report was quickly adopted. Later it developed that it was the intention of the subcommittee, by refraining from mentioning the Bitulithic specification, to have it eliminated from the society's standards. Then pandemonium broke loose anew. Every wile of the experienced parliamentarian was invoked to kill the resolution eliminating Bitulithic. The ignorance of parliamentary procedure displayed at this stage of the meeting would have disgraced a high-school debating society. The resolution was finally laid on the table, and Bitulithic still holds its proud position as the only patented paving which is a standard of the society.

Then it was moved to reconsider the asphalt specifications, and the battleground was shifted from the Warren to the asphalt interests. Again an attempt was made to quash the question, but finally, on a roll-call vote, the amendment to adopt the alternative form of specification was lost. During this roll call a well-known official of one of the large asphalt-producing companies brazenly stood in the front of the assembly hall and tabulated the vote as it was taken.

The recital here does not do justice to the evening, but is sufficient to indicate the chief cause of the trouble—a constitution that allows entirely new matter to be brought up at a meeting and to be adopted at once as a standard of the society. Had the membership been notified a month in advance that the alternative asphalt specification would be proposed and that the elimination of Bitulithic would be considered, argument would have taken the place of obstructionist tactics. It is, of course, not desirable to prevent the introduction of new matter on the floor of the convention. The society should restrict itself in its constitution, however, to the privilege merely of referring such new matter to committee.

The other cause of the disturbances is the influence of the materials manufacturers. Their pulling and hauling is looked on as a legitimate feature of the society's work, while the impression is strong that too many men holding active membership hearken to "their master's voice."

In the revision of the society's constitution it would be desirable, in the opinion of this journal, to eliminate entirely the making of specifications. That work should be left to bodies with more conservative traditions, with a well-ordered procedure which cannot be manipulated by manufacturers. Paving specifications made by the American Society for Testing Materials and the American Society of Civil Engineers would command the respect of everyone in the municipal field.

It is too much, however, to expect that the society will go that far. Its members feel that specification-making is one of its legitimate functions. The material interests, moreover, have a great influence, indirectly, in the society and it is certain that they would strenuously oppose (not by vote, for they are not allowed to vote) the giving up of this part of the society's work. The best that can be hoped for is a revision of the specification-making procedure. Tentative drafts should be placed before the membership in advance of conventions so that the requirements can be scrutinized and voted upon intelligently. The specifications should then be adopted tentatively for a year, and their final adoption, after a second vote in convention, should be by letter ballot.

This procedure would help to place the society on a better basis. Further than that, however, the society must go. Those who in the past have exercised the chief control in the organization must be eliminated. They have been accustomed for so many years to the scheming of the materials manufacturers that they are callous to the disgraceful manipulation and will not be likely to insist upon the needed reform. New men, not those of the old régime, should constitute the committee which will revise the constitution.

Then, too, the membership requirements must be raised and those barred and eliminated who have suspicious relations with paving material interests.

Finally, consulting engineers who are retained by material interests should be ineligible to membership on committees whose work affects those interests. The Engineering Record submits that it is ethically improper for these men to pretend to represent the public where such interests are at stake.

While the procedure at Newark last week was disgraceful in the extreme there is indication that just such an exhibition was needed to awaken the society to a realization of the sorry exhibition it was making. If that has been accomplished, the meeting of Oct. 12, bad as it was, will not be without benefit to the engineering profession.

Contractors' Methods on Welland Ship Canal Work Present Interesting Variations

Traveling Concrete Tower Introduced on Lock Construction Rivaling That of Panama—Central Crushing Plant Utilizes Heavy Rock Excavation—Entire Canal Laid Out as Single Piece of Work

REHOISTING towers—traveling on the low level and working at the point of deposit—are being used on the Welland Ship Canal for placing from 400,000 to 1,500,000 cu. yd. of concrete in lock structures nearly 100 ft. high and from 800 to 2500 ft. in length. Although the method will perhaps be improved as the work progresses, it is said to have already shown a clear advantage under these conditions over handling large buckets of concrete with cranes and derricks, and over direct chuting from a central plant.

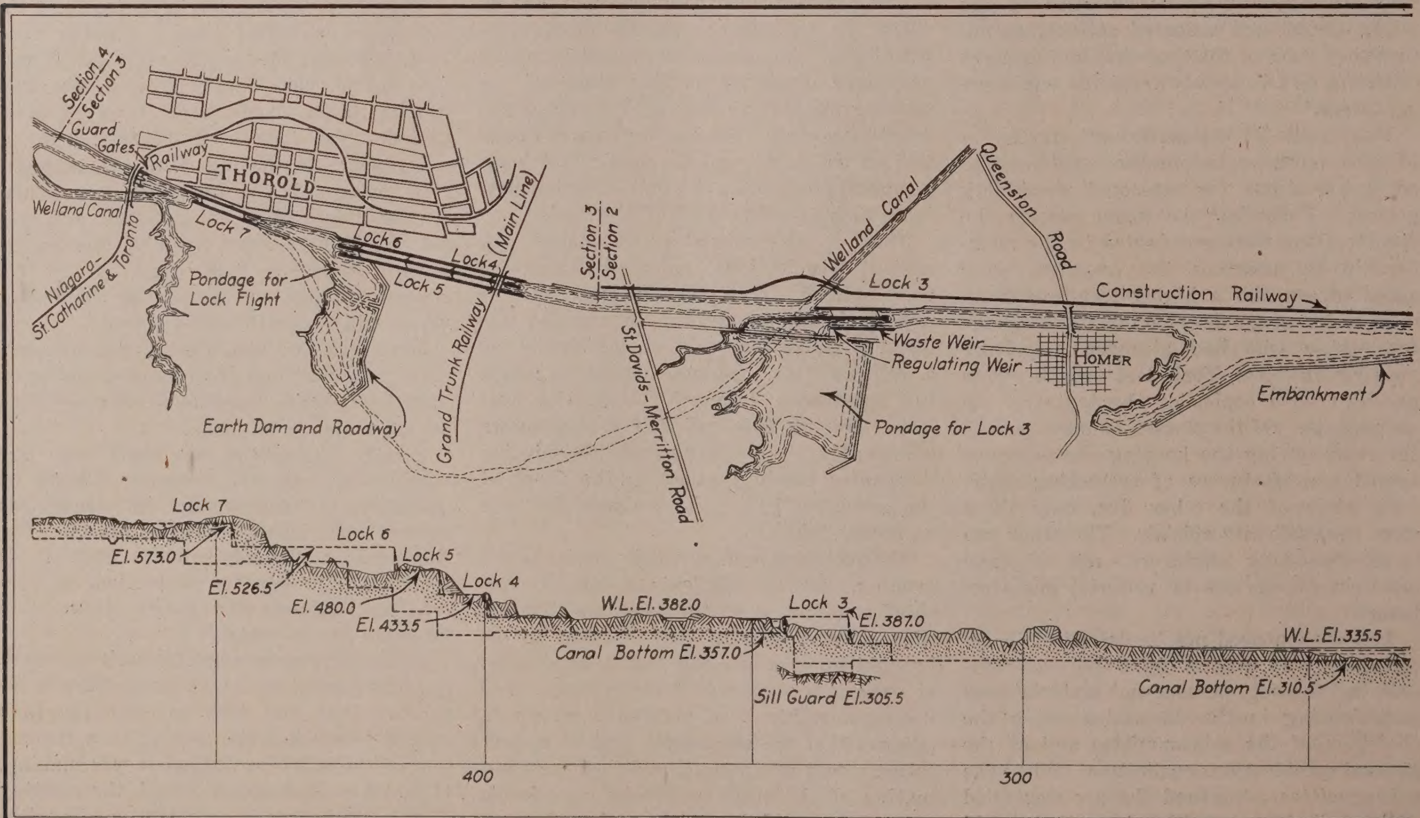
Apart from the immense volume of concrete work, interest in the construction centers in the manner in which the entire canal has been laid out as a single piece of work, although actually divided into nine distinct contracts, ranging up to $10,000,000 each in cost. The bulk of the concrete and rock excavation being at the north end of the canal, the first three sections were let at once, so that rock excavated on one of the sections could be crushed to supply aggregate for most of the large structures. For distributing this stone and to furnish transportation from the steam-shovel cuts to the 7000-ft. jetties that will protect the new Lake Ontario entrance at Port Weller, a double-track railway, ballasted with stone, was built and is maintained by the government along the west side of the canal for joint use of the first three sections. As the only large volume of concrete outside of these sections is in the guard lock, No. 8, near the south end of the canal, and as the only other available aggregate was gravel brought in from Lake Erie, a considerable saving is realized under this plan.

In addition to the three northerly sections, Section 5, which consists chiefly of excavation that could be carried on without interfering with the operation of the Present Canal, was started and the material removed is being used to refill part of the Old Canal which supplies water for power developments. Although two large sections —Section 8, which contains the guard lock and is the next on which bids will be asked, and Section 4, on which there is heavy earth and rock work—remain, the back of the work will be broken when the four sections under way are finished. The remainder of the work required is the widening and straightening of the existing canal and of the Welland River and the construction of improvements needed in the harbor at Port Colborne, the Lake Erie terminus of the canal.

LARGE CRUSHING PLANT FOR UTILIZING EXCAVATED ROCK

The main crushing plant, which has reached an output of 3000 tons in a day of two 10-hour shifts, is located at the north end of the rock cut for the triple flight of twin locks on Section 3 and is the southern terminus of the construction railroad. Being north of the point where the Grand Trunk Railway crosses the canal, this location made a crossing of the construction railroad with the Grand Trunk unnecessary. It also made it possible to lay out an approach line with easy grades for the construction trains, from the downgrade end of the excavation for the lock flight, while still keeping the crusher plant outside the lines of the canal. Rock from the construction trains is dumped into a gyratory crusher capable of breaking a 42-in. stone. A bucket conveyor carries the stone from this crusher to the screens and secondary crushers, the final product being carried by belt conveyors to bins under which cars on the main construction railroad are run to be loaded by gravity. This plant is furnished and operated by the contractors for Section 3 as part of the contract, stone being supplied for the other sections in cars at the plant.

The good rock strata were interleaved in many cases with red shale, and as all the rock excavation was taken out by steam shovels this shale became mixed with the hard rock in excavating the lifts. Accordingly, much of it was crushed and, although a large percentage was removed by screening, still some of it was stored in the large stock pile west of the plant. Being suitable for concrete when first broken, this shale in the storage pile weathered during the first year until it could not be used as it stood. A washing and screening plant was therefore added to the crushing plant, and is being operated, using the stone from this pile as a reserve. Water is obtained by gravity from the canal through a 12-in. cast-iron pipe. The sludge is caught in a



PLAN AND PROFILE OF WELLAND SHIP CANAL FROM THOROLD TO LAKE ONTARIO—LOCATION OF LOCKS, EMBANKMENTS settling pond adjoining the canal near the crusher.

CONTRAST IN CONCRETE-PLACING METHODS

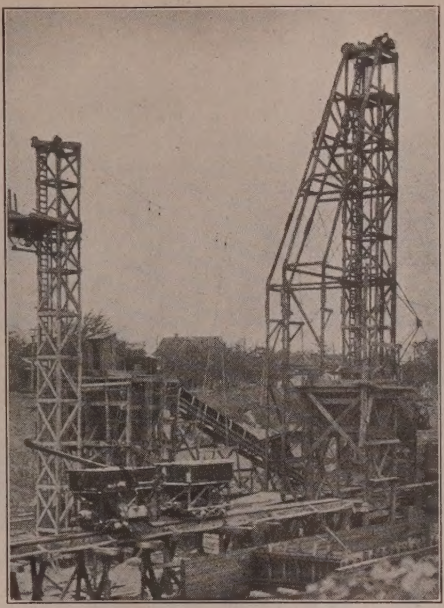
At the present time four methods of placing concrete are in use on the first three sections. On Section 1 the concrete is being mixed and delivered to cars on the lock floor, which are carried to either of two rehoisting towers, one of which brings the wall up to half height and the second of which is considerably taller and follows the first, completing the wall.

On Section 2 two different methods are being employed. One of these comprises a spouting plant with double hoisting towers and an extensive system of chutes, located at the head of Lock 2. This plant is building the upper entrance walls to the lock, the breast wall and the upper forebay. A single 2-yd. mixer feeds both the towers. The remainder or main portion of the lock is built with concrete handled from cars on the lock floor to place in 4-yd. buckets by locomotive cranes.

On Section 3 the concrete is being mixed on the lock floor, hoisted and spouted to cars on a trestle at convenient height for pouring the footings direct and for dumping into the skip of the rehoisting tower, and is being placed by the latter, which extends the full height of the wall. This plant is being used to concrete Lock 7, while the guide walls of Lock 6 have already been largely concreted with derricks. Derricks were also used in building the guide walls on the upper level at Lock 1.

CONCRETING FROM CARS ALONG TOP OF WALL

The west guide wall on the lower side of the lock on this section has been concreted from cars running along the top of the wall on a track supported by the structural-steel reinforcement required for the counterfort-wall section used here. The concrete is raised to this level by a tower located at the central mixing plant. It was only on Lock 1 that this method could be used, as under the bids received for the other sections it was found cheaper to use mass concrete and gravity sections for the approach walls. On Sections 1 and 3 for practically all of the time only a single 1-yd. mixer has been employed. On Lock 3 in Section 2 a smaller volume of concrete has been placed so far with the cranes, although a 2-yd. mixer is employed. On Lock 2, where two 2-yd. mixers are employed with the spouting plant, about half of the concrete in the lock walls proper has been placed. The tendency seems to be to keep the unit batch for hoisting in the towers down to 1 yd., while the batch transported varies in all cases from 4 to 6 yd.



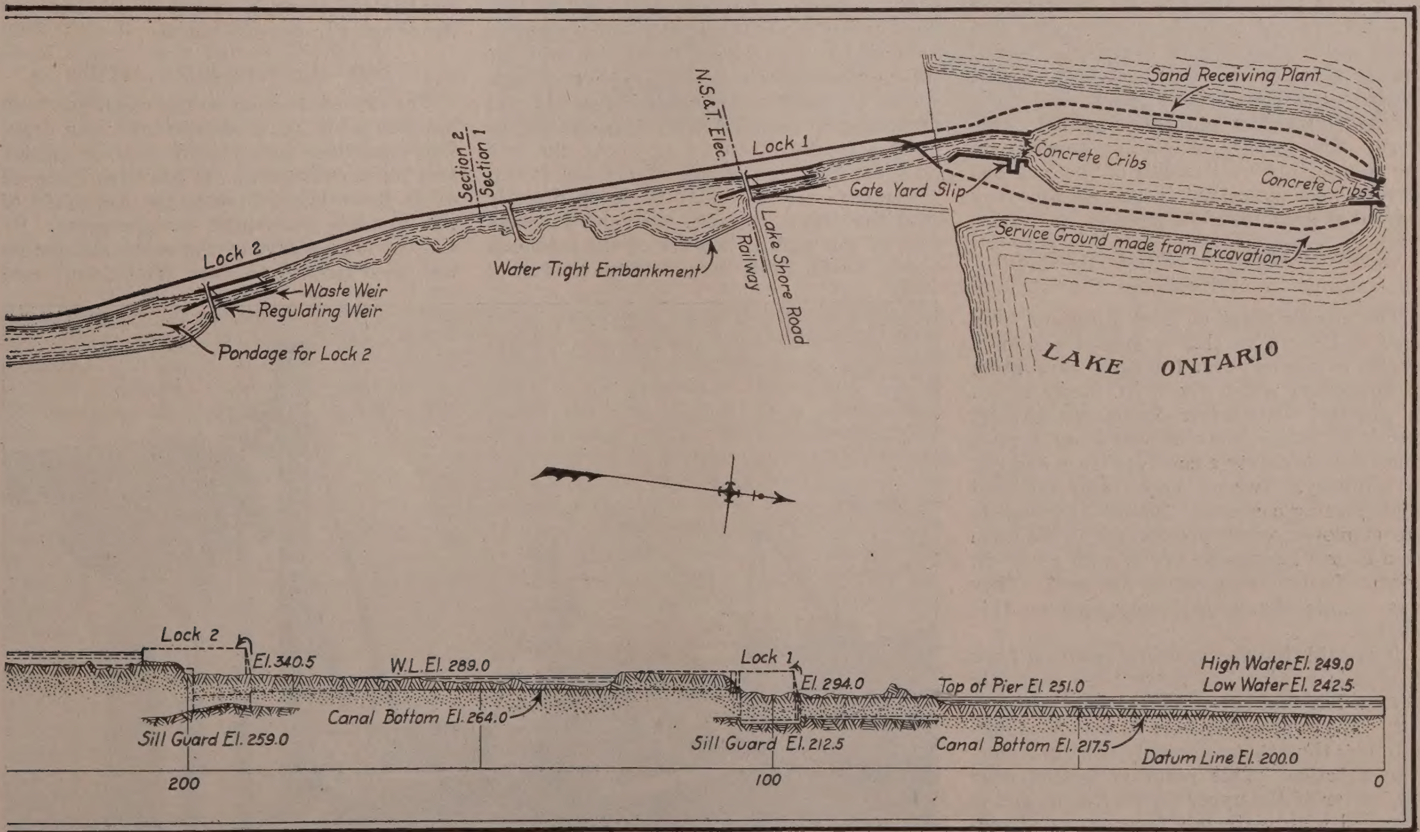
MIXING PLANT USED AT LOCK 7

The mixing plant at Lock 1 is located north of the lock chamber near the middle of the west guide wall, a section of which has been left out temporarily. Sand and stone are dumped from a siding on the main line construction railway into bins on the side of the bank back of this plant. The sand for this, as well as for the section above, is received by boat on Lake Ontario and unloaded with grab buckets into bins over the tracks on the west jetty at the canal entrance. After being dumped into the sidehill bins at this plant, either sand or gravel, as required, is raised by a belt conveyor to bins erected over the mixer. This mixer discharges either into a lower skip in which concrete is hoisted to be placed in the guide wall or into a 6-yd. capacity hopper which is used to load the cars taken to the rehoisting towers in the lock.

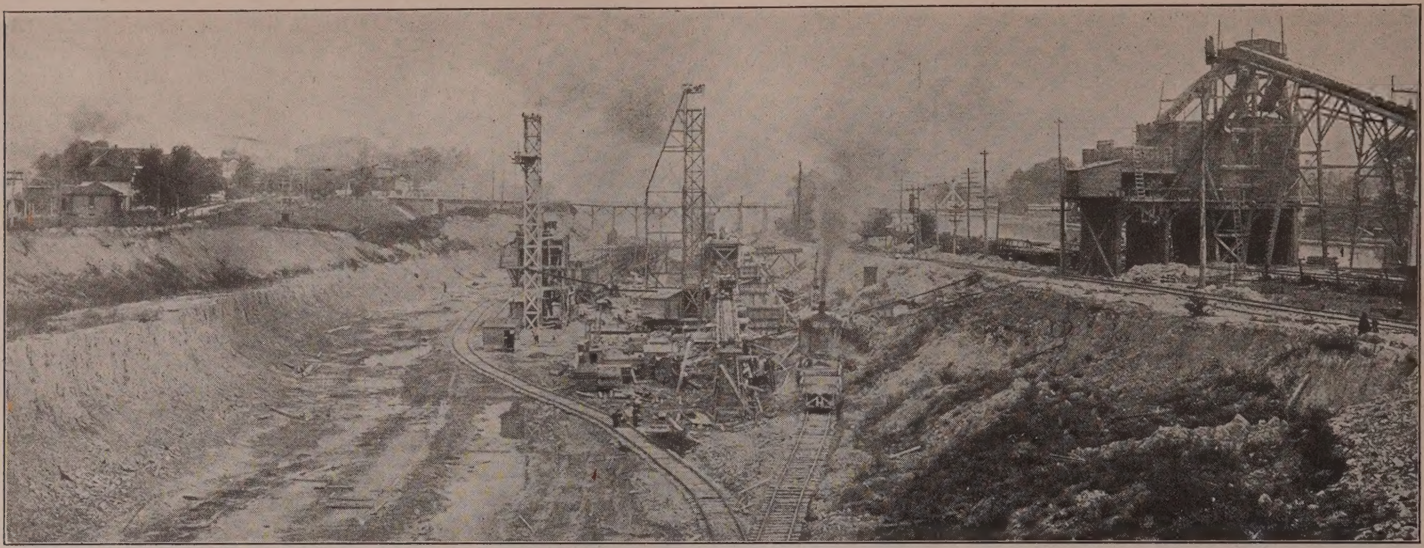
TIMBER BASES FOR REHOISTING TOWERS

Each of these rehoisting towers rests on one corner of a timber base about 30 ft. square, on the opposite corner of which is the hoisting engine. Four trucks under the corners of this base carry the tower on two tracks which form a part of the delivery track system on the lock floor. On one of these tracks next the lock wall rides an inclined track, which is supported from and carried along with the base of the tower. The lower ends of the rails of this track are cut off on a bevel and rest directly on the running rails wherever the tower happens to be. Two 6-yd. cars, each handled by a dinkey, transport concrete to these towers. The cars are pulled up the incline by a cable from the hoist. They dump into hoppers from which concrete is drawn as needed to the tower skip.

At the head of the tower a short length of chute supported from a boom is used to distribute the concrete in the form. This has been found much superior to using a



AND PONDAGES FOR LOCKS—DOUBLE-TRACK CONSTRUCTION RAILROAD, STONE BALLASTED, PARALLELS NORTH BANK OF CANAL



CONCRETE LAYOUT AND REHOISTING TOWERS AT LOCK 7—PRESENT CANAL BEHIND SCREENING PLANT IN RIGHT BACKGROUND

chute hung between the tower and some support on the wall. It is noticeable that here, as well as on other hoisting towers on the canal, small hoists and low rope speeds are used. While no time studies have been made, it is thought that, as now arranged, this hoisting speed is the limiting factor in the speed with which concrete can be placed by this method. Blaw steel forms have been used on this lock, and are fastened by rods extending diagonally downward to anchor blocks set in the previous lift. These forms and also the wooden end and corner forms have been handled by derricks traveling along the cut bank back of the walls, leaving the lock floor free for the traveling towers.

Just south of this lock is a crossing of a single-track electric line, which will be carried on a drawbridge resting on the upper approach walls. North of this line these walls have already been concreted by a separate plant, from which the concrete was transported in buckets on cars to derricks which placed it in the wall. One of the traveling towers will probably be used to hoist concrete to the upper level from the north mixing plant to complete this work. The method of placing concrete in the counterfort walls north of the lock has already been described in the Engineering Record of July 10, 1915, page 56.

Cranes Handle 4-Yard Batches on Lock 2

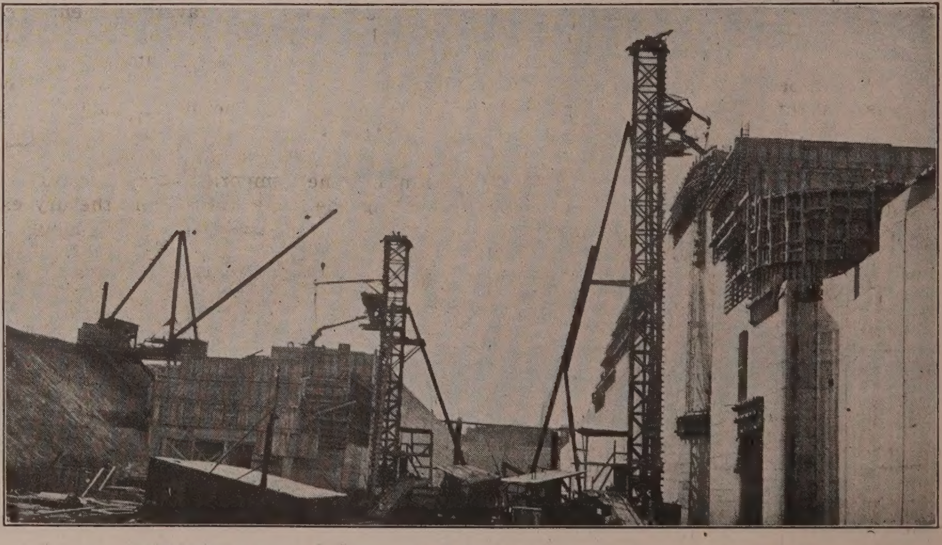
The mixing plant on Lock 2 differs from that at Lock 1 in that a spur track on a trestle is run out over the canal excavation to bins from which the 2-yd. mixer is fed by gravity. This mixer discharges directly into 4-yd. skips, four of which on a platform car constitute a concrete train handled by a dinkey. Two of these trains are used when placing concrete. Double-line buckets are employed, which are dumped in the form by a 25-ton locomotive crane with an 80-ft. boom. Two of these cranes are used. They also handle the wood forms used on this section.

It is said that the spouting plant on Lock 2 of this section has never been correctly adjusted so that it could be given a real tryout. The rope speed here is also considerably less than that commonly used in American practice. This plant is located near the center of the upper forebay floor, and is supplied with materials from the construction railroad, which are hoisted by bucket conveyors to bins over the concrete mixers.

On Lock 6 of the third section the concrete plant for building the outside walls was located at the southeast corner, where it could readily be supplied by rail. Concrete carried in skips on cars was run from this plant on a trestle along the base of the east wall to the point of deposit, where it was handled by a derrick. For the opposite wall, a tower and chute were employed to spout the concrete across the width of the lock to a hopper over a similar trestle along the base of the west wall, from which the bucket trains were filled. The derrick work, however, was found to be the slowest of all the methods tried for depositing concrete, and last season in beginning the construction of Lock 7 the contractor built an elaborate rehoisting tower braced in two directions so as not to require guys, which are used on the larger tower on Section 1. Like the towers on this section, the one at Lock 7 travels on track laid on the lock floor and is pulled along by tackle operated from its hoist. In order to concrete the wall progressively so as to have several working points available at once without providing a second tower, this contractor built a trestle about 20 ft. above the lock floor for the cars which supply the tower. These cars are thus able to dump directly into the forms for the first and heaviest lifts of the wall. They are of the side-gate type. To fill these cars without having to bring them down to the lock floor, a tower was erected at the mixing plant in the center of the lock, from which concrete is spouted to a hopper built on the trestle. This mixing plant is supplied by rail, and the bins over the mixer are supplied by bucket conveyers from the level of the lock floor. It would have been possible, as with Lock 6, to bring stone from the main crushing plant and sand from Lake Ontario up through the flight of locks on the construction track. However, the contractor has elected to buy gravel and sand from Lake Erie, bring them down through the present Welland Canal on barges to a point where this canal passes within a stone's throw of the chamber of Lock 7 and unload them at an independent screening plant. Railway cars are loaded from overhead bins at this plant and switched down to the lock floor. Much of this sand and gravel also have been stored in the lock chamber of Lock 6 for the construction of the center wall and floors and for use on Lock 5.

Spoil Used to Build Jetties

The dry excavation on the canal has been handled with steam shovels and with dragline excavators with 1½-yd. to 4-yd. buckets and Western graders. It has been disposed of in three ways, besides the use made of the limestone excavated for aggregate. By far the larger part of the earth excavation has been carried to Port Weller and used



REHOISTING TOWERS WITH SHORT CHUTES PROVE EFFECTIVE AT LOCK 1 in constructing the jetties protecting the entrance to the canal. A considerable yardage of the earth excavation of Sections 1 and 2 has been used in constructing levees and an earth dam forming the pondage for Lock 2.

Much of the earth excavation of Section 3 has been disposed of in a similar manner in building a large earth dam, which has a concrete core wall to rock where it could be reached and a sheet pile cutoff for the remaining length. This dam will form pondage for the flight of twin locks. The area covered here extends across the present canal, which is in operation and cannot be interfered with until the new canal is in use. A temporary dam, shown on the plans, has therefore been built in the same way as the permanent earth dam to provide pondage for the initial operation of the new canal. The old canal here makes a loop to the east of the new one, recrossing it a short distance north of the lock flight. It will be possible to take boats from the new canal into the old at this point, if desired. When the construction for this purpose has been completed, the temporary dam referred to will be removed as soon as the permanent dam can be completed across the old canal.

MAKING EMBANKMENTS

The fill for these structures is being delivered by train from the steam shovels, dumped and rehandled by two large steam drag-line machines equipped with 5-yd. clamshell buckets, which are able to scatter the material so it can be leveled with scrapers and rolled in about 1-ft. layers. The material in the levees on Section 2, on the other hand, put in place with teams and wagons loaded principally by Western graders, has been so packed in placing that rolling is not required. Practically all of this material is clay, though there will be a rockfill at the toe of the dam on Section 3.

The only dry excavation not disposed of as outlined is being used to fill in low land outside the navigation lines of the canal at the north end of Section 3.

As will be remembered from the article in the Engineering Record of July 12, 1913, page 35, the structures on the canal are being built to provide a navigable depth of 30 ft. at extreme low water, while the excavation is being carried only to a depth of 25 ft. Future depth can thus be obtained at any time by dredging out 5 ft. of the canal bottom. A drainage cut has been carried 20 ft. wide in the floor of the canal prism as far south as Lock 3. This cut is 10 ft. deep, and is for the purpose of allowing the locks to drain off during periods of repair in the winter and spring. It was also of advantage in keeping the prism dry during construction.

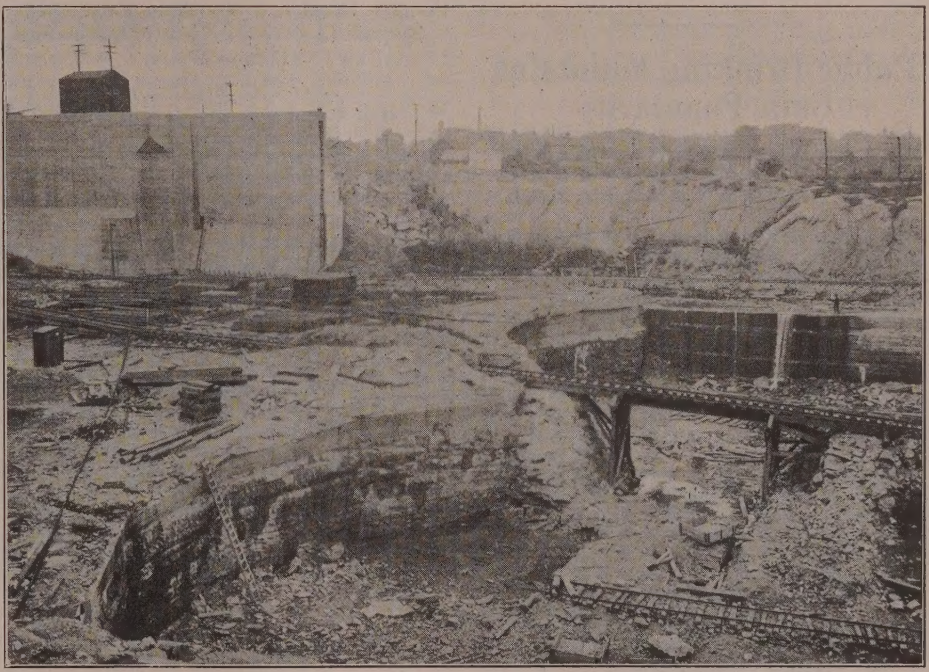
ROCK CUT TAKEN OUT FULL DEPTH

The contractor for Section 3 is removing the 2,500,000 yd. of rock from the site of the flight of twin locks by steam shovels. Electric well drills are used to drill the blast holes, which are usually 40 ft. in depth. From 20 to 57 holes containing from 5 to 13 tons of dynamite are fired at a time. The steam shovels on this work are, of course, operated from the downgrade or north end. The rock excavation for the flight of locks itself, representing more than half the total for the section, is practically complete in the pits for the two upper locks of the flight. The rock in the pit for the lower lock of the flight has only been partly stripped as yet.

It is intended to pour the concrete of the lock walls against the sides of this rock excavation without forms or backfill. For securing a vertical face, as required by the specifications, the contractor elected to use channeling machines. As these only had a vertical range of about 10 ft., the full-depth excavation was not carried to the edges of the cut. The benches left at the sides were shot down in lifts of convenient height for the channeling machines, of which a number were employed at one time.

DIPPER-DREDGE WORK

Section 5, where the work consists of widening and deepening the present Welland Canal, is being excavated by dipper dredges loading into dump scows. These scows are towed down the present canal to a point just below Allenburg, at the north end of the section, and dumped into a basin adjoining the canal. The material is pumped from this point by an 18-in. hydraulic dredge over the west bank of the canal into low ground, which is to be filled as described at the beginning of the article.



BETWEEN LOCKS 5 AND 6, SHOWING CHARACTER OF EXCAVATION ENCOUNTERED

The contractor for Section 1 also has in service a number of dipper dredges which have been used to excavate the entrance channel as far as the shore line. This material was loaded into dump scows and used to fill to within a few feet of low water the site of the jetties surrounding the entrance basin. This preliminary filling rendered it much easier to construct and maintain the temporary trestle used for handling the spoil trains from the dry excavation sections. The sides of the channels leading from this basin, both into the lake and into the canal, are protected by the reinforced-concrete cribs, the construction and placing of which were described in the Engineering Record of April 10, 1915, page 458. The dredging in this basin is well along, while the fill on the west side is almost complete, and that on the east side is more than half finished. The basin now furnishes a sheltered harbor for the dredging fleet, which at the beginning of the work was forced to run for Port Dalhousie at every storm.

A core of earth has, of course, been left between the shore line and Lock 1, to be taken out by the dredges after the lock is finished. Little water comes through this core from the lake, and pumping is almost unnecessary.

The sections of the canal now under construction are crossed by seven highway, two trolley and two railroad bridges. A temporary trestle structure has been used for one trolley bridge and one or two of the highway bridges, while the other highways have been cut or carried across on low embankments. One trolley and one railroad bridge, however, both of which are on Section 3, were a different matter. These lines were carried across the canal section on steel bridges supported by concrete piers extending below the lines of the excavation. So far as possible the piers were placed to come within the lines of the completed concrete structures, guard gates being located at the crossing of the Niagara, St. Catharines & Toronto Railway and the Grand Trunk, crossing the lower end of Lock 4. As during construction these bridges had to be about twice their final length to allow for the side slopes of the excavation, it was decided not to attempt to place the permanent steel until the canal structures were complete. Short spans, which it is hoped can be sold at the conclusion of the work as complete railroad bridges, have accordingly been used at both locations. For the foundations of the Grand Trunk bridge it was necessary to construct cofferdams more than 80 ft. deep on one side and only 55 ft. deep on the other, with the railroad line in operation on the high side. Some heavy shoring was required, but the work was accomplished without accident.

PROGRESS DELAYED BY WAR

It is thought that, so far, a fair test of methods and rates of progress possible has hardly been furnished by the construction operations on the canal. The labor shortage in Canada has been even more serious than in this country, and the few men that could be obtained are difficult to hold and to work with. In addition, the proposition, which is a large one, has presented many problems to the contractors engaged, and more attention has been paid to getting started on lines that will prove economical in the long run than to making rapid progress.

The entire work on the Welland Canal is in charge of the Department of Railways and Canals of the Canadian Government, for which department J. L. Weller is engineer in charge of the work, and W. H. Sullivan principal assistant engineer. The general contractors for the four sections now under construction are: The Dominion Dredging Company, Section 1; Baldry, Yerburgh & Hutchinson, Section 2; O'Brien & Doheny and Quinlan & Robertson, Section 3, and the Canadian Dredging Company, Section 5. In addition to numerous other subcontractors on the work, Lane Brothers are carrying on the concrete work described on Lock 1; the reinforced-concrete cribs on Section 1 are being built and placed by J. H. Tromanhauser & Co.; the steam shovel excavation on Section 2 is being carried out by Yale & Reagan, and that on Section 5 by J. H. Corbett & Sons.

Public Drinking Fountains Gain Popularity

Total First Cost at Portland, Oregon, $364.80 Each — Monthly Water Cost for Twenty Fountains, Running Continuously, $15.30

Twenty public drinking fountains of the type shown in the illustration have been installed in the downtown streets of Portland, Ore. The locations were determined with respect to the heaviest pedestrian traffic, and the fountains were placed in such a way that one is to be found every few blocks throughout the entire business district. It is notable that they have advanced rapidly in popularity as the public has become accustomed to their use, and the "drink habit" is now common to all classes.

THESE FOUNTAINS RUN CONTINUOUSLY

The standards are made of cast bronze and the spouts and interior of the bowls are highly polished. The standards cost $317 each, f.o.b. Portland, and the installation charge was $47.80, making the total cost, installed, $364.80 each. The funds for this improvement were donated by S. Benson, a philanthropist interested in civic improvement. The park bureau of the city provides for the cleaning and polishing, which totals about $200 per year, and for repairs amounting to about $100 per year. The water is supplied from the municipal system.

The fountains run continuously 24 hr. per day throughout the entire year. This amounts to an estimated daily flow of 3825 gal., or 510 cu. ft. On this basis, the flow per month is 15,300 cu. ft., which, figured at 10 cents per 100 cu. ft., costs the city about $15.30 per month for water.

It is believed that the advertisement in this manner of the city's abundant supply of exceptionally good water is well worth the cost entailed, and there is little doubt that since residents have become accustomed to the plan any suggestion of its abolition would meet with a storm of protest. It is not unusual to find all four units of a fountain engaged, and during business hours each fountain is usually in service the greater part of the time.

Bazin vs. Ganguillet and Kutter

Peculiar Relation Is Found to Exist Between Formulas Commonly Used for Calculating Flow of Water

By A. G. HILLBERG
Hydraulic Engineer, New York City

Engineers working constantly with problems pertaining to the flow of water in open channels as a rule prefer the Ganguillet and Kutter formula to the Bazin. Some engineers, however, especially in some countries abroad, prefer the Bazin equation, because it is of later origin than the Kutter.

As is well known, the Kutter formula was first published by the Swiss engineers Ganguillet and Kutter in 1869, four years later than the appearance of the first Bazin formula, which was published in 1865. The second Bazin formula appeared in 1897, or twenty-eight years after the Kutter formula, and its form makes it the most convenient to work with. Logically, it being the latest of all, it should also be more accurate, as the experimental material available was most extensive.

Second Bazin Formula

However, if the second Bazin formula is compared with the Kutter it is found that the values of C vary considerably for different conditions. This is shown in the following:

For smooth channels the coefficient of roughness as given by Bazin is about 0.06, while that given by Kutter is 0.012. The coefficient C, therefore, as figured by the Bazin formula and for R varying from 0.6 to 3 varies from 138.2 to 148.1, the difference being about 10. On the other hand, the coefficient C for the same variation in R as figured by the Kutter formula, using slopes varying from 0.000025 to 0.01, will vary from 90.1 to 149.4, the difference being about 60.

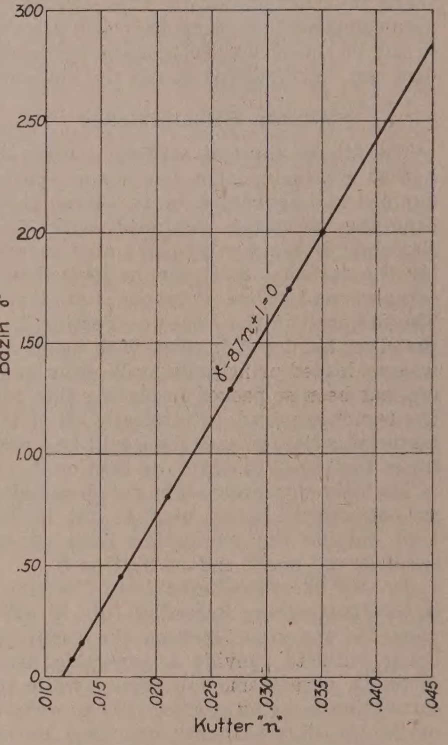
For river beds in bad order the Bazin coefficient is about 2, while the Kutter coefficient is about 0.035. The coefficient C by Bazin therefore for R varying from 0.6 to 3 varies from 27.8 to 50.9, the variation being about 23. For the same variation in R and for slopes from 0.000025 to 0.01 the Kutter formula gives a C from 25.8 to 50.7, a variation of about 25.

Consequently for rivers in bad order the formulas agree better than for smoother channels. It is also obvious that, when the slope is steep, and consequently the influence of the term $0.00281/S$ in the Kutter formula is negligible, both formulas give almost identical results.

These facts have led the writer to investigate the relation between these formulas, so as to make clear the relation between the different coefficients, as he believes that for ordinary calculations of the flow in rivers the Bazin formula should be used. However, as the Kutter coefficients are widely known, and as nearly all experiments made in this country have been made in order to determine the Kutter coefficient, it is necessary to establish a relation in the form of an equation, a curve or a diagram from which the corresponding Bazin coefficient can be obtained.

In doing this a very close relation has been found, so close as to make one doubt the originality of the Bazin formulas. This will be shown in the following:

Both formulas were published in the metric system, but as the reader is more familiar with them in their transcribed form the English system will be used. Obviously, it does not matter in a discussion of this kind which form is used, and the computation given in the following can easily be repeated in the English system by those interested in checking the result.



RELATION BETWEEN COEFFICIENTS TAKES FORM OF STRAIGHT LINE

Comparison of Formulas

As is well known, the English form of the Kutter formula reads:

$$C = \frac{\dfrac{1.811}{n} + 41.65 + \dfrac{0.00281}{S}}{1 + \left(41.65 + \dfrac{0.00281}{S}\right)\dfrac{n}{\sqrt{R}}} \qquad (1)$$

while the second Bazin formula (1897) reads:

$$C = \frac{87}{0.552 + \dfrac{\gamma}{\sqrt{R}}} \qquad (2)$$

The latter formula, through multiplying

both terms by 1.811, can be given the following shape:

$$C = \frac{157.6}{1 + \frac{1.811\gamma}{\sqrt{R}}} \qquad (3)$$

When studying the shape and construction of these formulas it becomes evident that they are of the same general form, or

$$C = \frac{a}{1 + \frac{b}{\sqrt{R}}}$$

Now for certain conditions both formulas will give the same result. When this occurs, because of their being of the same form, the numerators can be equated and the denominators likewise. In that way the following system of equations has been established:

$$157.6 = (1.811/n) + 41.65 + (0.00281/S) \qquad (4)$$

and

$$1.811\gamma = [41.65 + (0.00281/S)] \times n \qquad (5)$$

If now equation 4 is multiplied by n and equation 5 subtracted from it, we have

$$157.6n - 1.811\gamma = 1.811$$

which divided by 1.811 becomes

$$\gamma - 87n + 1 = 0 \qquad (6)$$

As is seen, the slope term is eliminated, which is a check on the writer's observation as previously mentioned. Equation 6 gives directly the relation between the Kutter and Bazin coefficients of roughness, and it is the same whether the original equations are given in the English or in the metric system. It is also obvious that the relation is in the form of a straight line, and it has been plotted in the accompanying diagram.

To show the close check between the coefficients as calculated by equation 6 and as generally used, the accompanying table has been computed. It gives the type of channel, the coefficient γ as recommended by Bazin for the various types of channel, the Kutter coefficient n as calculated by equation 6 and the latter as generally assumed.

ASSUMED AND CALCULATED COEFFICIENTS

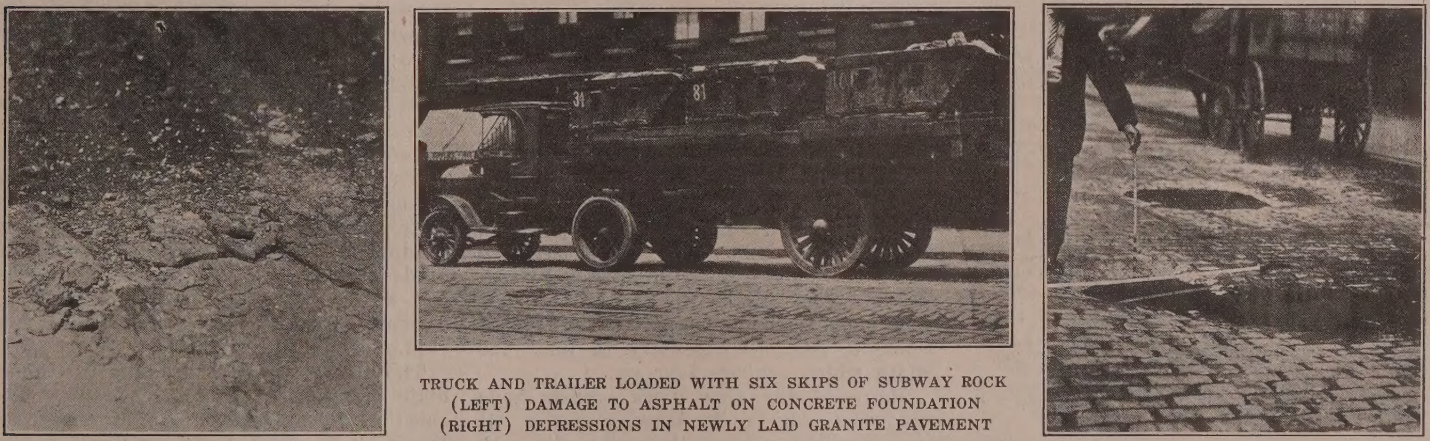
Type of channel	Bazin's γ	Kutter's n: As calculated by equation 6	Kutter's n: As generally assumed
Planed boards or smooth cement	0.06	0.0122	0.012
Well-laid brick	0.16	0.01335	0.013
Rubble masonry	0.46	0.0168	0.017
Firm gravel	0.80	0.0207	0.020
Excavated canals in good order	1.30	0.0265	0.025
Excavated canals in bad order	1.75	0.0316	0.030
Rivers	2.00 or more	0.0345	0.035 or more

The check between the assumed and calculated values is so close, and the relation between them so simple, that it appears quite possible that the second Bazin formula is nothing but an abbreviated form of the Kutter formula. Therefore in cases where the slope is so steep as to make the slope term in the Kutter formula negligible, the Bazin formula can be used with the same degree of accuracy as the Kutter formula, which also checks the writer's observations, as previously mentioned.

Pavement Damage Calls for Truck-Weight Restrictions

E. W. Stern Discusses Injury to Asphalt and Granite Block by New York Subway Construction Haulage

SO GREAT has been the damage to some of the best pavements in the Borough of Manhattan, New York City, by heavily loaded, steel-tired trailers hauled by motor trucks that the municipal authorities are considering measures for limiting the weight, size and speed of all vehicles using the city's streets. The situation was summed up last week by Eugene W. Stern, chief engineer of highways, Manhattan, in a paper presented before the American Society of Municipal Improvements, from which the following extracts are taken:



TRUCK AND TRAILER LOADED WITH SIX SKIPS OF SUBWAY ROCK
(LEFT) DAMAGE TO ASPHALT ON CONCRETE FOUNDATION
(RIGHT) DEPRESSIONS IN NEWLY LAID GRANITE PAVEMENT

15-TON LOADS

The chief offenders are contractors' outfits hauling rock from the subway excavation on Broadway. They consist of tractors and trailers, each carrying six large skips, weighing about 15 tons. The trailer wheels are 41 in. in diameter, with steel tires 8½ in. wide. The load per inch width of tire is about 1400 lb. The springs are very stiff, and this fact has unquestionably contributed to the destructive effect of the wheel loads of the trailer. The jarring effect of the loaded vehicle is such that people along the route traveled complain about excessive vibration in their buildings.

The route traversed has been along sheet asphalt and granite pavements, both on concrete foundations. These pavements are all substantially about four years old. They are considered among the city's best pavements, and have been laid in conformity with the latest specifications. Up to the time when the damage began to be done by the trailers no appreciable amount of wear had been noticed beyond what ordinarily might be expected on thoroughfares with as much traffic as have the streets mentioned.

The mischief has all been done in a very short space of time, about nine months, and has amounted to 5400 yd. of repairs on granite (equal to 32 per cent of the total area), costing $6,000, and 1900 yd. of repairs on sheet asphalt (equal to 30 per cent of the total area), costing $1,900. Prior to this time the average cost per year of maintenance on the granite was $150; on the sheet asphalt, $70.

The accompanying photographs show a loaded truck and the amount of damage that has been done to the pavements. On granite pavements the granite blocks have been literally crushed and ground into powder. In some cases the blocks are actually split. While the granite is not what might be called "hard," still it is of the quality that has been successfully used on the best types of pavements in New York. It was quarried at North Jay, Me., and Rockport, Mass.

On the sheet asphalt the destructive effect has been equally startling. In some places it has been ground to small bits; in other places the fiber of the wearing surface has been completely broken and cracked. It has also shoved in places and shows many depressions, waves and ruts.

In many cases the 6-in. concrete base has been shattered. In many other cases, however, where the wearing surface has been damaged, the foundation remains intact. The speed of these vehicles was about 6 miles per hour in the daytime, and at night it was considerably higher—12 and 14 miles per hour.

The question of restraining the contractor from hauling such excessive loads was submitted to the corporation counsel, and his answer was that as there was no ordinance restricting the loads on vehicles it would be very difficult to obtain any relief until suitable legislation was obtained.

RUBBER VS. STEEL TIRES

Practically no damage has been caused by motor vehicles in which all of the wheels are covered with rubber, beyond what is reasonable, although there are some types of heavily loaded trucks in use in the city. The first-class pavements show practically no additional expense for maintenance beyond a reasonable amount.

The manufacturers of motor vehicles have found by experience that about 750 lb. per inch width of tire is all the load the rubber tire will stand, and this load and the resiliency of the rubber and the adequate springs on motor vehicles, which good construction demands, seem to be the saving features in protecting the pavements against undue wear, even under heavy loads.

The trailer, however, comes in an entirely different class. Not being rigidly connected with the vehicle having the engine and the more or less delicate mechanism, it need not have the rubber tires, nor the easy springs to prevent damage to the tractor. Hence builders of these, who form a distinct class from the motor vehicle manufacturers, have allowed their fancy no restrictions in the designs of the trailers, their principal object, according to Mr. Stern, being to provide a vehicle having the greatest tonnage capacity at the least cost, without considering the destructive effect on the pavement caused by the excessive loads, narrow steel tires, small diameter of wheels, and inadequate springs.

It becomes evident, therefore, that immediate action must be taken to protect city pavements and country highways. Otherwise the taxpayers will be called upon to make very heavy payments to maintain their streets and highways, although these may have been constructed in a thoroughly first-class manner and in accordance with the latest ideas.

REGULATIONS GOVERNING LOADING OF VEHICLES

CHICAGO, ILL.

Maximum weight of vehicle	15 tons
Maximum load on any one axle	12 tons
Maximum load on the wheel	6 tons
Maximum load per inch width of tire	1000 lb.
Maximum length	40 ft.
Maximum width	8 ft. 6 in.

Speed—Compatible with safety, but not to exceed 9 miles per hour; not to exceed 4 miles per hour when truck has defective tire which would cause injury to pavement. Motor trucks must have rubber tires. Trailers must have steel tires.

NEW YORK STATE

Maximum weight of vehicle	14 tons
Maximum load on any one axle	9 tons
Maximum load per inch width	800 lb.
Maximum width, 8 ft. 4 in., except traction engines, which may have a width of	9 ft. 2 in.

Speed—Under 4 tons, 15 miles per hour; over 6 tons, 6 miles per hour, with steel tires; over 12 tons, 12 miles per hour, with rubber tires.

STATE OF NEW JERSEY

Maximum weight of vehicle	12½ tons
Maximum load per inch width of tire	800 lb.

Speed—4 tons, 12 miles per hour, with iron tires; 6 tons, 8 miles per hour, with iron tires; 6 tons, 10 miles per hour, with rubber tires.

STATE OF PENNSYLVANIA

Maximum weight of vehicle	12 tons
Maximum load on any one axle	9 tons
Maximum load per inch width of tire	750 lb.
Maximum width, 7 ft. 6 in.; for buses in large cities	8 ft. 4 in.

STATE OF MASSACHUSETTS

Maximum weight of vehicle	14 tons
Maximum load per inch width of tire (except for hard pavements.)	800 lb.

Speed—4 tons, 15 miles per hour; 6 tons, 6 miles per hour, with iron or steel tires; 6 tons, 12 miles per hour, with rubber or similar tires.

OAKLAND, CAL.

Maximum weight of vehicle	14 tons
Maximum load per inch width of tire (except for hard pavements.)	800 lb.

Speed—4 tons, 6 miles per hour, with iron or steel tires; 4 tons, 12 miles per hour, with rubber tires.

ENGLAND

The English have much the most complete and scientific ordinances of any that Mr. Stern has examined:

Maximum weight of vehicle	12 tons
Maximum load on any one axle (for trailers, 4 tons.)	8 tons
Maximum weight of vehicle without load	5 tons
Combined weight of motor car and trailer	6½ tons

Weight on axle to be proportioned to diameter of wheel.

The load per inch width of tire (steel) shall be 840 lb. for wheels 3 ft. in diameter; and an additional allowance of 9⅓ lb. for every additional increase in diameter beyond 3 ft.; and for wheels less than 3 ft. in diameter, a deduction of 18⅔ lb. per inch width of tire for every inch less in diameter than 3 ft.

Vehicles for military service are limited as follows:

Weight of car (unladen)	6 tons
Weight of car (with trailer)	8 tons
Unit of registered axle weight with tires shod with cross bars	560 lb.
Maximum width, 90 in. for 3 tons; for trailer	90 in.

Speed—Dependent on axle weight for iron-tired vehicles, 6 tons, 12 miles per hour for rubber tires; over 6 tons, 8 miles per hour for rubber tires. Should car unladen weigh more than 3 tons, speed is limited to 8 miles per hour. If motor draws trailer, maximum speed is 5 miles per hour.

Regulations properly framed to protect the pavements against the destructive effects of excessive loading in vehicles should, Mr. Stern believes, take into account the following factors:

1. That the wearing or damaging effect of wheel loads on pavements is a function of (a) the load, (b) the diameter of the wheel, (c) the width of tire, (d) whether or not the tire is of a resilient material such as rubber, or of steel, (e) the kind of springs.

2. That speed has considerable to do with the damaging effect produced by heavy loads.

An investigation of the laws and ordinances governing the weights and loads of vehicles, etc., adopted by eight states and forty-nine cities in the United States and Europe, goes to show that only a few laws have been drafted in accordance with modern conditions. It is surprising that even to-day in this country certain communities require that the width of the tire should depend on the diameter of the axle, regardless of the loading. Others make no distinction in the regulations between a wheel large or small in diameter, while still others treat rubber and steel tired wheels the same.

Some of the most up-to-date ordinances are presented in the table.

WIDTH OF VEHICLES

Unless some limitation is placed upon the size of vehicles, the tendency will be to make them larger and larger, until they will become a nuisance and congest the highways. This is now becoming evident in New York, as well as in other cities. In order to provide reasonable standing room on each side of a street, and at the same time allow traffic to proceed in both directions, it becomes necessary to limit the width which vehicles take up.

Many of the New York streets have roadways only 30 ft. between curbs. It thus becomes evident that with the curb lines occupied, vehicles over 7 ft. in width do not allow for two to pass, even using the utmost care. While it is becoming necessary to widen roadways in Manhattan, it is very difficult to add more than 2 ft. to each side. A 30-ft. roadway is thus converted into a 34-ft. roadway. In this case a 7½-ft. width for a vehicle would be the limit.

Joint Operation of Research Laboratory Planned

Portland Cement Association and Lewis Institute, Chicago, Agree to Co-operate on Investigations of Practical Value

WITH the purpose of broadening the scope of tests and insuring practical application of the results, the Structural Materials Research Laboratory of the Lewis Institute, Chicago, will be operated jointly by the institute and the Portland Cement Association, according to an agreement entered into on Sept. 1. There is thus assured in this country a plan which has been successfully used by Germany for many years, whereby an association of manufacturers makes provision for a scientific study of the uses of their product and its value to the general public. The Lewis Institute laboratory will be utilized in carrying out exhaustive research into the properties of concrete, reinforced concrete and aggregates, and the influence of various factors upon the manufacture and placing of concrete.

At present the laboratory occupies about 8000 sq. ft. of floor space, and contains equipment for making all the usual physical tests of concrete and concrete materials. As an adjunct there is a chemical laboratory for testing the impurities of natural sands. A considerable part of the work already undertaken has been carried out in co-operation with several committees of the American Society for Testing Materials. Committee C-9, for example, supplied funds for equipping and operating the chemical laboratory for the study of impurities in sands and related problems. Tests of reinforced-concrete fence posts have been made for a committee of the American Railway Engineering Association, and tests of concrete to determine the effect of time of mixing have been carried out for the National Conference on Concrete Road Building.

EXPERIMENTAL WORK IN PROGRESS

The scope of experimental work, either completed or in progress, is indicated by the following list: A comparison of results of tests of mortar and concrete, using twenty-three lots of cement, of interest also in showing the most satisfactory form of test piece; effect of fineness of grinding on the strength of mortar and concrete; a study of the impurities affecting the concrete-making qualities of natural sands; wear tests of concrete, with reference to use in roads; effect of variations in consistency on strength of concrete; a study of concrete aggregates to determine effect of size and grading and the relative value of different kinds of aggregate, and the use of mechanical sifters for determining fineness of cement. Tests are now being made at the rate of about 40,000 a year.

The laboratory work is under the immediate direction of Duff A. Abrams. The chemical investigations are in charge of Oscar E. Harder. Four assistants aid in the conduct of the investigations. The results of the research work thus far completed have been embodied in reports of technical committees of the various societies mentioned.

Recommends Waste Collection by Motor Trucks in Chicago

Waste collection by wards or small districts with motor trucks, at least experimentally, is the recent recommendation of the finance committee of the Chicago City Council. An investigation by the committee disclosed the fact that politics affected to a marked degree the conditions surrounding the collection and disposal of ashes and garbage. In many instances team owners were assessed from 50 cents to $1 per day per team, and withal the system tended to bring an inferior kind of service. The committee recommended, in addition to the motor truck proposition, a method insuring selection and continuance of teams on the basis of efficiency. Definite specifications for horses are 1400-lb. animals, 16 hands high, chunky, short bodies, full ribs, clean leg bones and a good-shaped foot. The council has approved the recommendation by a large vote.

Co-ordinated America Demands Participation of Engineers

Technical Men Should Take an Active Part in National and Local Politics—Mere Voting Not Enough

By THOMAS C. DESMOND
Consulting Engineer, New York City

ONE of the most difficult and important problems of America to-day is that of how properly to co-ordinate our democracy. We are trying out on this continent an experiment at democracy which has not yet been proved an enduring success. The definition of co-ordinate is: To bring into common action, movement or condition; to regulate and combine in harmonious action; to adjust, to harmonize. The effort of today should be to co-ordinate our whole national life so that America may be a truly great nation—a nation great in other ways than merely in regard to the extent of its natural resources; and the engineers of America have in them the power to help largely to bring this about. The American nation was founded on certain ideals of democracy. The great leader of America in the days of the Revolution, George Washington, was trained as an engineer in his youth, and the example which he gave of constructive public service should be an inspiration to all other engineers.

National Team Work Needed

We have here a democratic government and not a strongly centralized government. We have decided that our people shall not be controlled too directly by any governmental power. If therefore we are to accomplish collective results at all, we must find a substitute for that direct governmental power by developing in our people some sort of democratic spirit of team work. The many people of foreign birth in America, with their differing sympathies, help to make this difficult. But by some means we must get the mass of people of all sorts which we have here to pull together willingly for the common good. It is this that is meant when it is said that we must co-ordinate our democracy, and it is this problem that the engineers of America may well take part in helping to solve.

A great significant fact of the present war has been the realization of France and the other Allied Powers that if they are to have any hope of succeeding in the struggle they must develop a national efficiency to some degree approximating that of Germany. And so in France as well as in England and the other Allied countries we have seen an extraordinary development of national co-ordination. The previously discordant elements of French national life have been welded for the time at least into a harmonious whole, and it is France, a nation of one purpose, with its people co-ordinated and efficient, that now faces the world. The war has repaid something of its cost to France by its wonderful development of French character.

Those of us who still believe in the ideals of democracy as expressed by our forefathers in the founding of this nation will not want America to substitute German ideals. Nor does any one of us want this country to go through the terrible agonies of war for the indirect benefits which result from war. But the facts before us should set us all earnestly thinking. We should realize that whether we have any military dangers to fear or not we shall at any rate have to endure a world-wide industrial conflict after the war is over. The nations that will compete against us are those that are now being welded into unity by great necessity. It is well that we should be examining the state of our own country and helping in every possible way to keep it in a condition to withstand successfully any strains, any dangers, it may have to undergo.

Big Problems Involve Engineering

There are many reasons why, in working on national problems, the help of engineers will be especially effective. This is largely an engineering age and engineers are responsible for much of the complexity of modern life. The development of applied science, with its tremendous effects on the economics of production, has changed greatly the relations of people to each other and the relation of the government to the people.

The problem of transportation, for instance, with its important connection with the interests of all of our people, is essentially an engineering problem. Consider one means of transportation—the railroads of America—and think how vitally interested every one in America must be in the condition of these railroads. The railroads have become the very arteries of the country; they are almost indispensable. If we are ever to have a properly co-ordinated democracy in America it is evident that the relations of the railroads and the people must be on a sound and just basis. The engineers of America have been largely responsible for the building and operation of the railroads, as well as for other works of applied science, and America should utilize the help of the sane judgment and influence of these American engineers in keeping railroad conditions in accord with other elements of our national life.

Health Problems Important

With no sacrifice of individual liberty, except where that individual liberty menaces the public welfare, more attention should be paid to the health of our people. In this work our sanitary engineers can be of the greatest assistance. The marked lowering of the death rate that has come in many cities from proper engineering supervision of matters of water supply and sewage disposal is known to all. The beneficial results which follow proper engineering attention to matters of street cleaning, garbage disposal, etc., are also very important. Engineering studies of the housing conditions of our people, particularly in the tenement districts of the large cities, may also be productive of much good. We are a prodigal, reckless nation, reckless of the health and lives of our people even while we have the scientific means at hand to preserve them. Needless deaths and needless sickness certainly make for national inefficiency, and engineers can show very well the advantages of a co-ordinated America in helping to safeguard the public health.

Is a democratic form of government really unsuited to human nature as it now exists? Is a strongly centralized, autocratic government really a better form of government under which to live? To every American who still cherishes the democratic ideals for which his forefathers fought the answer must be "No" to both of these questions. But at the same time the obligation rests with the man who answers "No" to see to it that he does his part toward making our ideals of democracy practical. American men have always answered the call to national duty in times of war, and, if they can be brought to realize fully the need, they will answer the quieter calls to duty in times of peace.

It is urged that some kind of system of universal military training would be of great help in co-ordinating American life. It is suggested that a particular advantage of military training is the discipline it gives to the minds of young men, with a strengthening of their character. This is undoubtedly true, and a system of universal military training would certainly help greatly to co-ordinate America. One might call attention, in this connection, to the effect on engineers of the severe technical training which they undergo. Engineers must acquire in school and out of school a mental control and fixed standards of truth, or else they do not succeed very well as engineers. Engineers are not perfect as a class by any means, but they are generally men of strong character, and for this reason alone they can be effective forces for good in a democracy.

Naval Consulting Board's Work

The general question of military preparedness in America will not be touched on here, but it is desired to mention something of the well-known work for preparedness that has been done by that group of engineers which is called the Naval Consulting Board. This association of prominent engineers, with the assistance of many other engineers throughout the country, has been making inventories of all of the manufacturing establishments in the United States. The resources of each manufacturing establishment, the number and kinds of the different machines contained therein, have been noted with a view toward their use in making munitions in time of war. This kind of work, done by engineers, certainly represents real preparedness, and it is a great step toward national co-ordination. No individual liberties or privileges have been disturbed, no owner of any manufacturing plant has lost anything by the information he has given, but the country as a whole has been greatly benefited. It is an excellent instance of the kind of public service which engineers can render America.

The public has been made familiar of recent years with the extraordinary results of increase in efficiency of production which have attended the introduction by engineers of the principles of scientific management into many industries. In a few cases where cities have appointed city managers, engineers have been given these positions, and have done well in carrying out some of the principles of scientific management in the administration of city affairs. This is a good thing; efficient government in itself helps to co-ordinate American life. It is a tribute to engineers that they should be hired as capable city administrators. But if engineers are to be most effective for good government, they should be not merely governmental employees, but the men of power behind the government as well, the leaders of public opinion, and this implies that they should be active in city, state, and national politics.

This is indeed the fundamentally important work which engineers must do if they are to accomplish the best results in helping to co-ordinate our democracy—they must become more active in politics. The government of a democracy is the government of the people, and unless the people take an active interest in the shaping of that government the government will suffer, and with it the whole national life will suffer. There is no escape from the logic that a democracy can not be successful unless its best qualified citizens take an active interest in its welfare. And such an interest means more than merely voting at the polls on the days of general elections. It means that since in America we have the party system, engineers should, for the best results, be active in political party organizations in helping to choose good party candidates for office, good party programs of legislation, and doing other general political party work.

ENGINEERS AND POLITICS

The interest of engineers in politics should not be merely a temporary thing, kept up during some particular campaign. It should be a lifelong interest, kept up as a matter of duty. By activity in politics, and particularly activity in political party organizations, engineers will be able to make their beliefs effective in a powerful way. They will be able to affect the currents of public opinion at the source. With more good men active in party organizations, other good men will consent to stand as candidates for public office. We shall get back more of that fine spirit in American life which deems it a high honor to serve the State. And a popular respect for government, brought about by the kind of democratic government that can be respected, will do much to help co-ordinate America.

It has been said several times in this article that it would be well for us to have a better co-ordination of our national life. The dangers which may result from unco-ordinated, disintegrated national conditions are very real. It is unpleasant, and probably unnecessary, to point out that there have been other experiments at democracy in the world's history before, and they have failed. There have been other rich nations, and they have been destroyed. What it is wanted to emphasize now is the wonderful possibilities of this nation if it holds true to and makes more effective the democratic ideals of its founders. In the realization of these possibilities engineers can play an important part.

Cost of New Jersey's Roads Increased by Traffic and Difficult Construction

Special road problems in New Jersey are encountered, owing to the presence of marshes, to a relatively congested population, and to the location of that state between New York and Philadelphia. Because of the heavy traffic it has been necessary to construct more substantial, and therefore more costly, roads than in many of the other states. This cost has been increased by developing a number of the roads from turnpikes built in the early days along straight lines without regard to grade. The necessity for carrying highways over marshes and tidal inlets has also contributed to the cost. The approximate construction cost of roads in New Jersey up to 1914 has just been estimated by the U. S. Department of Agriculture as $140,000,000.

Sun Shipbuilding Plant Planned for Rapid Production of Special Standard Steamers

Main Building of H-Shaped Plan, with Mechanical Equipment for Direct Movement of Materials, Provided at 80-Acre Site on Delaware River

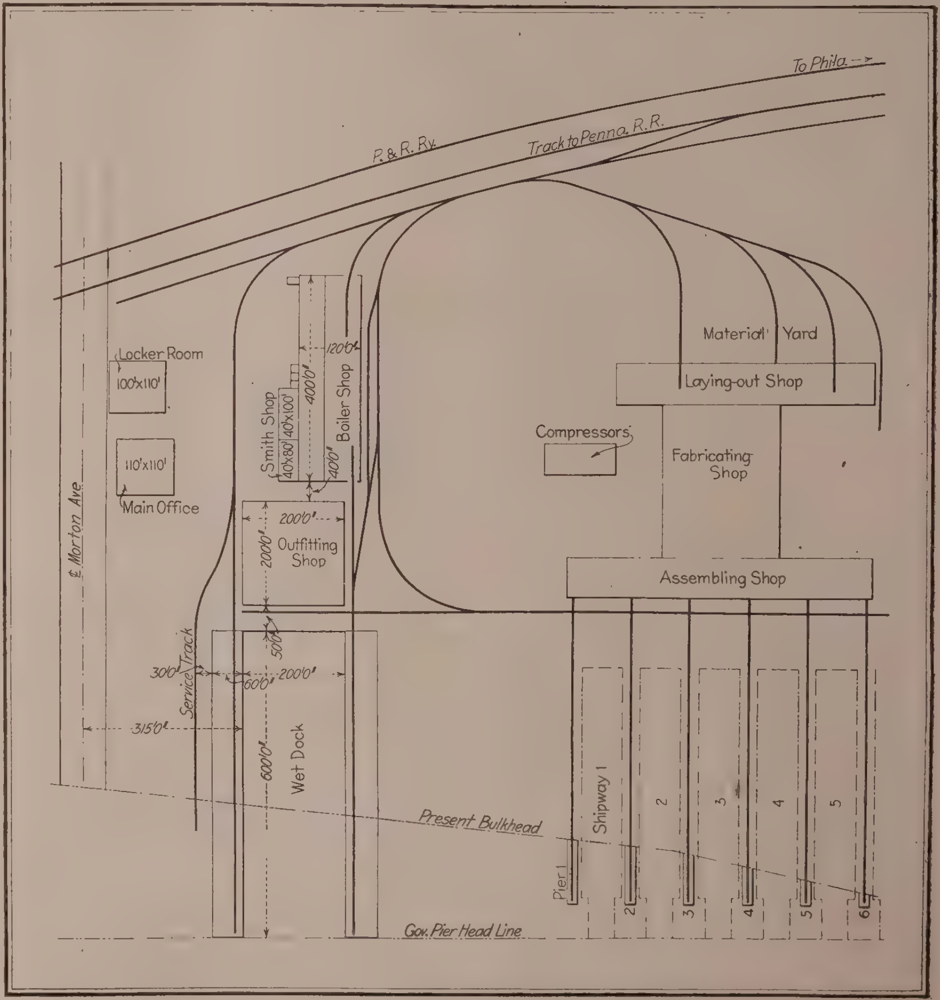
AFTER extensive study of shipbuilding establishments in Europe, the main building of the Sun Shipbuilding Company's new plant on the Delaware River at Chester, Pa., has been designed as a large H in plan in order to insure the most effective and direct movement of the materials from the stock yard where received by rail on spur tracks connecting with the Pennsylvania and the Philadelphia & Reading railroads to the finished steamer in the river. The cross-bar of the H is the wide fabricating shop equipped with electrically operated rollers instead of cranes to provide continuous movement of the material. Next to the stock yard on the north is the two-story part of the building, the layout shop in the first floor and the mold loft in the second floor. At the other end of the fabricating shop, next to the river, is the assembling shop, a one-story building, with a high crane runway for handling large sections of the hulls or ship framework. Crane runways nearly 100 ft. high and spanning 125 ft. then transfer the fabricated parts to the five reinforced-concrete shipways where the hulls are assembled preparatory to launching. After launching, the ships are placed in a 200 x 600 ft. wet dock near which the boiler shop and the outfitting shop are located.

Three standard types of freight ships will be built, with the idea of insuring rapid production, hence effective layout and handling facilities are especially necessary. It is expected that at least fifteen standard 10,000-ton steamers per year can be fabricated, and with improved organization a possible capacity of twenty steamers per year is contemplated. This means that about 5000 tons of steel must be taken into the plant and fabricated into a ship each month.

GENERAL LAYOUT OF PLANT

The Philadelphia & Reading Railway tracks bound the 80-acre site on the north, while the Pennsylvania Railroad will construct a spur crossing over the Reading and connecting to the tracks indicated on the plan. The material transported to the plant is delivered to the material yard, the boiler shop, the wet dock or the assembling shop and shipways, as desired.

The laying-out shop, the north side of the H, is 80 x 500 ft. in plan, two stories high, the first floor being used for the layout shop and the second floor for the mold loft. As seen in one of the photographs, the main building is a steel-frame structure of Bethlehem H-columns, with flat roof and monitors. Ample light, so essential in a



TRACK SYSTEM AND BUILDING LAYOUT TO FACILITATE MOVEMENT OF MATERIALS

LAYING-OUT SHOP ON LEFT CONNECTS WITH FABRICATING SHOP IN CENTER

building of this type, is provided by steel sash in side walls and monitors. The fabricating shop, 300 x 225 ft. in plan, connects the parallel end buildings. Long-span triangular trusses in the sides of the latter carry the roof and crane loads to allow columns to be omitted and thus insure free passage between the parts of the building. By omitting the interior columns in every other bay and carrying the roof framing on longitudinal trusses in the fabricating shop, or cross-bar of the H, the desired larger working spaces were obtained. The south side of the H, nearer the river, is the assembly shop, 80 x 600 ft. in plan, where parts of large size can be handled and thence transferred to the shipways. Electric traveling cranes serve both the laying-out and the assembling shop.

REINFORCED-CONCRETE SHIPWAYS IN VARIOUS STAGES OF CONSTRUCTION—MAIN BUILDINGS IN BACKGROUND

The shipways are constructed of reinforced-concrete columns and beams with concrete pile foundations at the inshore end and of timber deck and piles at the river end. After launching down these ways the ships are equipped in the adjacent wet dock, which accommodates two vessels, with room for a third at the outer end.

The boiler shop, 120 x 430 ft. in plan, and the outfitting shop are located near the wet dock and connected by track facilities to both sides of the wet dock, as indicated on the plan. The company has bought the engine-building plant of Robert Wetherill & Company, Inc., just across the railroad on the north, from which engines will be transported by railroad to the ships. Electrical power is to be used throughout, and a powerhouse with four 2500-ft. air compressors is located near the fabricating shop.

The total cost of the plant is estimated at $4,000,000. Construction of the concrete-pile foundation walls and concrete piers, which were found necessary in the soft soil encountered, began on June 22, and the erection of the steel work started June 30. The buildings are rapidly approaching completion, and it is expected that by November the plant will begin active operations. The Raymond Concrete Pile Company, of New York City, designed the foundations and the shipways, and the Belmont Iron Works, of Philadelphia, and Lewis H. Shoemaker & Company, of New York City, designed, fabricated and erected the steel-work of all the buildings and runways. The foregoing information was furnished by J. N. Pew, Jr., vice-president of the Sun Shipbuilding Company, of which J. Howard Pew is president.

APPEARANCE OF MAIN BUILDINGS ON SEPT. 25—ASSEMBLY SHOP ON RIGHT

How Should Abandoned Property Be Valued?

Of Three Classes, That Eliminated Because of Obsolescence or Inadequacy Should Be Included in Reproduction Cost

By R. B. SHEPARD, Jr.
Office Engineer, Valuation Department, Atlantic Coast Line Railroad, Wilmington, N. C.

ABANDONED property is one of the subjects in valuation work which offers large possibilities, and about which, nevertheless, comparatively little has been said. There are several classes of such property. In the writer's estimation the class which represents plant eliminated because of obsolescence or inadequacy in the course of the development of the road must, in fairness to the railroad, be embraced in reproduction cost new as a development expense.

ORDERS 2 AND 10

On May 12, 1914, the Interstate Commerce Commission issued its second order to the carriers under authority conveyed by the Valuation Act. This order commanded that each carrier file with the commission on or before Feb. 1, 1915, "complete and detailed schedules of all fixed physical property which it has abandoned prior to June 30, 1914, together with a complete and detailed statement of its claims with respect thereto." The order prescribed that the schedules be classified in accordance with the Interstate Commerce Commission investment accounts, and called for certain other information, data, plans, and the like. Later, on Dec. 23, 1915, the commission issued Order 10, modifying Order 2, so as to require the carriers to file the schedules, claims, etc., "within thirty days after the date fixed by the commission, as that as of which the carrier's property shall be valued."

It is manifestly impracticable, if not altogether impossible, to comply literally with the requirements of these valuation orders, because of the absence of records giving the details specified, and because of the physical changes wrought by time and the elements in property long unused precluding the accurate ascertainment of original construction quantities from field measurements. Further, the carriers might not be justified in expending the large sums which such field investigations would entail without having some understanding of the use to which the data would be put when obtained, and of their place in the general valuation scheme. No positive light has thus far been shed on these important questions by the

Division of Valuation, though there have been certain elucidating negative statements. For example, it was thought by the carriers that the cost of abandoned property might be included in the general statement of "original cost to date," but it now appears that the Division of Valuation construes the act to require the original cost of only those units of property in service on the date as of which the valuation is made.

In the interest of a clearer understanding of the economic principles involved, and for the purpose of bringing out sharply the vital interest of the carriers in just and reasonable application of those principles, it might not be amiss to present a short review of the usual history of abandoned property and an analysis of the consideration which led to its abandonment. It might also be remarked in passing that, while the economists and the engineering profession have a certain interest, more or less academic, in the problems arising as the valuation progresses, the very frame and structure of the railroad body is affected, and each question is susceptible of such determination as to cause a further drain on its very life blood.

THREE GENERAL CLASSES

Abandoned property may be broadly divided into three general classes:

1. Temporary structures or roadways built to facilitate construction of the permanent railroad, as run-around lines at tunnels, at heavy cuts, at big bridges, etc. This class of abandoned property, when pointed out by the carrier, will probably be included in the estimate of cost to reproduce, and can therefore be omitted from this discussion.

2. Property abandoned because of exhaustion of source of revenue. This class of abandonment is significant in connection with the total sum of capital expenditure made by the carrier during its career, but the cost of such property probably has been, or should have been, charged to profit and loss, closing the carrier's accounts with respect thereto. Any claims which the railroads might equitably present for this class of abandonment are dependent on what artificial economic conditions were produced by arbitrary governmental action affecting individual cases. No general rule can be formulated.

3. Property abandoned because of obsolescence or inadequacy, or in the course of development of the railroad. It is this class which constitutes the great volume of abandoned property, and it is the treatment this class is to receive that is a matter of concern to the carriers. The most important item is abandoned line, and the considerations leading to the abandonment of line in the course of development are to be the subjects of this discussion. The same reasoning governs in practically all voluntary abandonments, so one analysis will suffice.

WHEN IMPROVEMENTS ARE JUSTIFIED

Let us suppose a line of railroad built into an undeveloped country. The standards of location and construction must, of necessity, be low in order to keep the cost within limits commensurate with available business. In the course of time the country develops, new industries spring up along the line of road, and the volume of traffic offering so increases as to tax the original facilities. The management begins to consider the advisability of extensive improvements, and the engineer is asked to investigate and report upon the feasibility of reducing grades and curvature, and of otherwise improving the line and the probable cost. In his report the engineer gives his estimates of the total cost of the improvements and of the probable saving in operating expenses to result therefrom. If the yearly saving makes a favorable showing as a return upon the total estimated cost, the improvements stand a good chance of being authorized, but it is the total cost that enters into the calculation, and not the excess cost of the new line over the cost of the portion replaced.

Under conditions heretofore prevalent, the conservative carriers have welcomed the rule to charge the cost of the abandoned portion of the property to operating expenses, as it practically enabled them to build up the railroad partially out of earnings, strengthening the value of their securities, enhancing their credit and furnishing a reserve strength highly desirable. If, however, the capitalization is to be made a basis for regulating revenue, or for condemnation, an entirely new condition arises, under which it is neither advisable from the carrier's standpoint, nor economically just to require this charge. The stockholders actually do make the payments represented by the charges to operation, just as truly as if they were openly assessed, and unless they are allowed to recoup through greater returns on their nominal investment, they are permanently at a loss. It has been argued that once an amount is charged to operation the stockholders have no further interest therein, the public footing the bill; but this reasoning is fallacious, in that no increase in rates is authorized to equalize such charges, while a smaller sum is available for dividends or surplus during the years of extensive reconstruction involving large operation charges on account of abandoned line.

EXAMPLE

As an illustration suppose a road capitalized at $10,000,000 is earning 6 per cent, or $600,000 per year. Improvements to cost $2,000,000 would reduce operating expenses and increase earnings in the net sum of $120,000 per year, or 6 per cent. If money could be borrowed at 5 per cent there would result an increase of $20,000 a year in the funds available for surplus or dividends, and the work would probably be authorized, regardless of the required charge of, say, $500,000 to operating expenses on account of line abandoned. If the earnings were not affected by regulation the stockholders would not object to paying this sum out of earnings, and correspondingly reducing the issue of securities, for they would be reimbursed in the larger sum of $45,000 available for the purposes noted. The total returns would still be $720,000 a year, but the capitalization would nominally be $11,500,000 earning 6.26 per cent, instead of $12,000,000 earning 6 per cent.

If, however, the road were told it could earn only 6 per cent on the nominal capitalization of $11,500,000, or $690,000 a year, the situation would be decidedly altered. The stockholders would be forced to forego dividends to the amount of $500,000, or actually to invest this sum in addition to the borrowed $1,500,000, on which they could receive only $90,000 a year, or 4.5 per cent, which is less than the cost of money in the market. They would certainly decline to authorize the improvements.

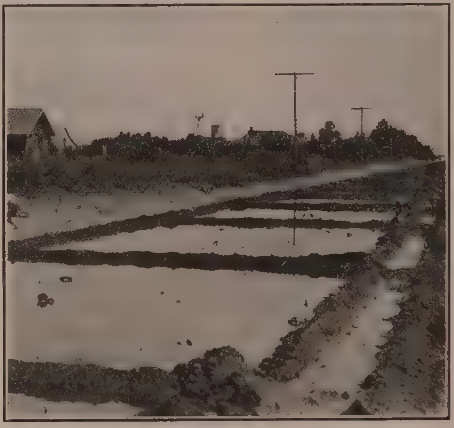
The lesson is that the $500,000 representing property abandoned in the reconstruction of the line on higher standards is an integral part of the cost of the final road, and as such should enter into the statement of such cost. It was manifestly proper to adopt original standards on a parity with the traffic requirements, and it would have been folly to construct the modern road before it was economically justified. To have done so would have placed intolerable burdens on both the shippers and the railroad, and probably would have involved the carrier in bankruptcy.

Under the current theory of valuation, the cost of reproduction of the identical property existing on the date as of which the valuation is made, must be determined, and to this added amounts corresponding to other values attaching to the business. It has been held in numerous instances that the cost of developing the property and the business must be included in the final statement of value. It seems that the cost of property abandoned in the course of development is an entirely appropriate item for inclusion in the "development expense" column.

Water Kept on Concrete Road by Additional Dike

Longitudinal Obstruction Insures Crown as Well as Sides Being Covered While Acquiring Strength

THE ORIGINAL method of diking roads in California has been improved by adding a longitudinal dike near the edge of the concrete, as shown in the picture. This prevents unnecessary loss of water and gives double assurance that the concrete will be covered at the crown of the pavement as well as at the sides while it is acquiring strength and hardness. The added dike is thought to make good results more certain. Even where water is obtainable for use in this manner it is desirable to prevent unnecessary loss. This is particularly true in hot climates, where evaporation is rapid and where scarcity of water more often prevails.



ADDITIONAL LONGITUDINAL DIKE INSURES THAT CONCRETE WILL BE COVERED AT CROWN

Atlantic Highway Almost Completed

First to be completed of the big border-to-border routes will be the Atlantic Highway, according to figures recently compiled by the American Automobile Association. East of Portland, Me., and from Quebec, Canada, to Miami, Fla., there are now less than 100 miles of unfinished highways.

Engineer Reports on Corrosion of 350-Mile Australian Steel Pipe Line 12 Years Old

Greatest Deterioration Noted Where Conduit Is Buried in Earth—Damage Small When Above Ground—Maintenance Costs Given Since Year 1902

FOR the maintenance and repair of the 351½ miles of 30-in. steel lock-bar pipe which delivers water from the Helena River to Coolgardie and Kalgoorlie in Western Australia approximately $250,000 was spent during the year 1914-15, according to the latest annual report of P. V. O'Brien, engineer for the Goldfields areas of the Water Supply, Sewerage and Drainage Department of Western Australia. The report, issued recently, and reproduced at length below, is devoted largely to a discussion of external and internal corrosion of the pipe metal and to the condition of the asphaltic coating. It appears that the greatest deterioration has occurred where the pipe has been buried in the ground, while sections lying above the surface show comparatively slight damage.

The daring pipe line and pumping project, described in the Engineering Record of Feb. 24, 1900, page 178, and May 21, 1910, page 671, was completed in 1902. After having been in service a few years the pipe showed signs of serious corrosion. The steel of this conduit was manufactured in Australia from material supplied from England. The thickness of the plates is ¼ in. for all pipes under pressure up to 390 ft. head and 5/16 in. thick for pressures above that amount. The material employed was open-hearth basic steel. When completed and tested the pipes were heated to 300 deg. Fahr. and immersed in a mixture of coal tar and Trinidad asphalt. Over the outside coating sand was sprinkled to make the material resistant to the sun's heat.

MAINTENANCE COSTS

Mr. O'Brien presents the following figures on the cost of maintenance since the pipe line was completed in 1902:

TABLE 1—COST OF MAINTENANCE OF 30-INCH STEEL MAIN 351½ MILES LONG

Year	Cost	Year	Cost
1902-3 1903-4	$83,500	1909-10	$83,000
1904-5	37,600	1910-11	61,200
1905-6	38,000	1911-12	83,000
1906-7	68,700	1912-13	111,000
1907-8	96,600	1913-14	192,600
1908-9	74,500	1914-15	248,000

During the year covered by the report extensive works were carried out in unearthing and recoating pipes in the country where external corrosion was bad. The total amount expended on this work was about $154,000.

The coating applied originally on the exterior of the pipes, Mr. O'Brien states, was found to be in good condition where the pipes were above ground and generally in a more or less perished condition where they were laid underground. The condition of the steel plate where the pipes have always been above ground was, like the coating, excellent. Where underground, the pipes were, on the whole, in good condition, although there were very few places quite free from slight corrosion.

The corrosion on the exterior of the pipes took three distinct forms—rusting, pitting and scaling. In ironstone gravel through the hills and elsewhere and in sand on some of the sand plains the pipes, Mr. O'Brien reports, were in very good condition—practically free from pitting and scaling, although freely covered with spots of rust under the decayed coating. This rusting was very slight, it is said, and has not appreciably damaged the pipes. The remainder of the pipe line is in clay and loamy country, more or less impregnated with salt and, of course, generally damp.

In this country there was widespread but slight rusting as in the gravel and sand, and in addition, many instances where pitting and scaling have occurred. The pitting and scaling were found generally on the bottoms of the pipes only, the top halves being, almost throughout the whole length of the main, in a uniformly excellent condition. The occurrence of pitting is due to a combination of several factors, in the absence of any one of which there can be no pitting, and is therefore very irregular.

SCALING AROUND LEAKING JOINTS

Scaling commonly occurs around leaking joints, and in salt (morrel gum) country. When once started it requires only moisture to eat itself rapidly into the steel. It is, according to Mr. O'Brien, the most insidious and dangerous type of corrosion, and requires most careful attention to detect and repair. Perforations through the pipes have occurred from pittings since 1905, but it is only during the last two or three years that the scaling corrosion has made itself apparent. The combination of factors that gives rise to pitting breaks down in time by the elimination of one of the factors, and the pitting stops. It is probable that only a few of the holes now occurring from external corrosion are due entirely to "pitting," although the corrosion in all other cases originated in the shape of "pits," and afterward proceeded by "scaling." A perforation arising from pitting alone is generally small in area and closely surrounded by steel of the full original thickness of the plate, and therefore easy to repair, while a perforation occurring after scaling has started is generally much larger in area and surrounded by thin metal with an irregular surface, making repairs much more difficult. The number of holes that have occurred from external corrosion are shown in Table 2.

TABLE 2—HOLES DUE TO EXTERNAL CORROSION

Financial Year.	No. of Holes.	Financial Year.	No. of Holes.
1904-5	2	1910-11	131
1905-6	27	1911-12	124
1906-7	54	1912-13	774
1907-8	55	1913-14	966
1908-9	91	1914-15	2,078
1909-10	177		

A large number of the holes that occurred in the year 1914-15 broke out while the pipes were being scraped after being unearthed and would not otherwise have appeared so soon.

Both pitting and scaling have been found to occur most frequently in certain classes of country, but while "pitting" is limited in the extent to which it can occur, there is no limit to "scaling," and it is only a question of time when, in the absence of preventive measures, the whole main would become affected and destroyed by scaling.

REPAIRS

The method adopted for dealing with external corrosion consists of uncovering the pipes wherever they are found to be badly pitted and continuing the opening up in both directions till they are found to be in good condition. In this way all those parts of the main in the vicinity of places where corrosion is known to be bad have been opened up, and in addition, other portions which were likely to be similarly bad have been opened up during the past year. The length opened up and left open for the financial year 1914-15 was 36½ miles, making a total of 80 miles uncovered at the close of the year. It is proposed to open up about 16 miles during the year 1915-16. Judging by the condition of the pipes that have been opened up during the past year, it is anticipated that the work of dealing with the external corrosion of the pipes can be satisfactorily dealt with for some years in the same manner as hitherto, and at no greater cost. Although almost the whole of the coating on the pipes where they are underground is more or less perished, and has been so for many years, the condition of the steel plates is, apart from the pitting and scaling already referred to, almost uniformly good. There is therefore nothing to indicate the advisability of the wholesale opening up of the pipes in order to repair the coating at the present time. The development of scaling will probably proceed slowly as in the past, and by unearthing the pipes at the same rate as this development, the main will be maintained without any material depreciation at a minimum cost and the expenditure will be spread over a number of years.

FRICTION AND CARRYING CAPACITY

The usual friction tests were carried out during the year. The most striking feature in this connection is that east of No. 4 pumping station there is not one section of the main that shows any increase in friction during the past twelve months. From No. 5 pumping station to Kalgoorlie there has been no appreciable change for the last four or five years, and any such changes as have occurred are in the direction of an improvement. The section from No. 4 pumping station to No. 5 pumping station showed a gradual increase in friction up to July, 1914, but appears now to have reached its maximum friction in the same way as those sections to the east of it, and is likely therefore to show very little change for the next few years.

The section from No. 3 pumping station to No. 4 pumping station shows a slight increase in friction during the past year, but it too will probably soon, if it has not already done so, reach its maximum friction without getting appreciably worse than it is now. The section from Northam to Cunderdin has shown gradual improvement during the past two years, and from Baker's Hill to Northam there has been very little change during the same period.

From No. 2 pumping station to Baker's Hill the friction increased considerably during 1914, on account of the deposit of carbonate of lime. As stated in the last annual report this deposit was thick at Mundaring and diminished gradually to a film only at Merredin. In order to ascertain the amount of protection afforded by this deposit, the lime treatment was stopped in January. Since then the water has dissolved some of the deposit and thus materially improved the carrying capacity of the sections from No. 1 pumping station to Baker's Hill, which is now very little less than it was in January, 1914. The tests for alkalinity of the water show that since the lime treatment was stopped the alkalinity at Kalgoorlie has been maintained at about the same degree as when the treatment was in use. Further improvement in the carrying capacity of the sections from No. 1 to Baker's Hill may thus be expected till such time as it is found advisable to recommence the lime treatment.

INTERIOR OF MAIN

The increase in friction that has taken place in the main has been due to the growth of nodules of rust, and between No. 1 pumping station and Northam also to the deposit of lime. The nodules of rust owe their origin to the corrosion of the steel at spots where the bituminous coating has been damaged (cracked or perforated), and the water has thus come directly in contact with the steel. From inspections of the interior of the main, it would appear that along the greater part of the length of the main at least half of the area of each pipe is practically free from nodules and on the remaining half the nodules are scattered over the surface at rates varying from one or two to 30 or 40 per square foot. Of the remainder of the pipes some are entirely free from nodules, while others are almost completely covered with nodules touching one another. These conditions clearly account for the wide variations in the friction in different sections of the main.

Over the areas that are free from nodules, and also between the scattered nodules on other areas, that is, over more than three-quarters of the whole area of the interior of the main, there is no incrustation of rust, and the surface of the bituminous coating is as smooth and clean, save for a slight brown slimy deposit, as when the pipes were made. Although the coating on most of the interior of the pipes thus appears on the surface to be as good as ever, it is nevertheless perished to such an extent by the action of the water that it is porous and allows moisture to reach the steel everywhere except at a comparatively few places where the coating is over ⅛ in. thick. The perished coating is much softer than the original coating. It is also brittle, and when dry crumbles to a powder when pressed between the fingers. This coating varies greatly in thickness (having a wavy or ribbed surface) from 1/64 in. to ⅛ in. Where the coating is thin, it must have perished within a few years after the pipes were put into use, but there is, even in these cases, very little corrosion of the steel. Under the thicker coatings there is still less corrosion. The thinner coating is easily rubbed off the plate, while the thicker coating adheres firmly.

CORROSION UNDER NODULES

It is only under the nodules that any appreciable corrosion is found. Under each nodule there is a corresponding pit. The pits are frequently found ⅛ in. deep, but rarely deeper. The pitting on the interior of the main is due to the same combination of factors as on the exterior, and that pittings rarely exceed ⅛ in. deep is due to the fact that by the time this depth is reached, one of the essential factors is, in most cases, eliminated. Under some comparatively rare favorable conditions, however, pittings go on to greater depths before the elimination of the factor takes place. A few cases have thus occurred where the pittings have reached a depth of ¼ in. and caused leaks in the pipes and many more will occur in the future, but the conditions favorable to such deep pittings are fortunately not so common in the main as to constitute any serious danger to the maintenance of the main for some years.

For the most part the strength of the main is not appreciably reduced by the internal corrosion that has taken place. It is only at those places which show the greatest friction, and where the nodules are closely encrusted over the pipe that any material amount of metal has corroded away, and the strength of the pipe been reduced, but even in the worst case there is sufficient metal left to give ample strength for some years.

A feature of internal corrosion that is likely to lead to considerable expenditure in a few years is the thinning of pipe ends. Many cases have been found where material loss of metal has occurred from corrosion round the interior of pipe ends, and a few pipes have had to be removed on account of the pipe ends becoming so thin that it was impossible to calk the joints watertight. All joints that have so far failed in this way have been yarned joints. It is probable that all pipe ends at joints that require frequent calking will fail in the same way, but it is not likely that any serious trouble will arise from this cause for the next two or three years.

LIME TREATMENT

As already stated, the lime treatment of the water was continued till Jan. 6, when it was stopped in order to ascertain the degree of protection afforded by the deposit already in the pipe. The tests made since then are so far favorable.

Tests are being regularly carried out to determine the changes in the friction in the pipes and the corrosive quality of the water so that the lime treatment of the water may be recommenced as soon as the indications are such as to show it is advisable. When the lime treatment is recommenced it will be necessary to provide more extensive settling basins or filters to adequately free the water from all suspended matter after the addition of lime.

The total amount of corrosion on the exterior of the worst pipes hitherto found is small, and the strength of the pipes has not been greatly diminished by it. In the future, also, with moderate maintenance, there is not likely to be any material reduction in the strength of the pipes from external corrosion, nor is there likely to be any necessity to remove more than perhaps a few pipes on account of such corrosion.

With regard to internal corrosion, all that can be done is to use every practicable means to reduce the corrosive activity of the water to a minimum, till such time as the strength of the pipes is reduced to the safe limit and then to lift, clean, repair and relay the pipes. The maintenance of the main can be carried on for the next three or four years without having to resort to such extreme measures as removing any great number of pipes, but the insidious progress of general corrosion on certain sections of the main and the thinning of many of the pipe ends are inevitably bringing the time nearer when these measures must be resorted to. In the meantime, careful attention is required to minimize the corrosive quality of the water and to watch the progress of the corrosion that must go on, in order to determine the most economic time for relaying sections of the main. No great disadvantage accrues by delaying such work, as long as a reasonable margin of strength remains in the pipes, and the pipes can then be cleaned and repaired at comparatively small cost, and recoated so as to be fit for a further long period of service.

Card System Records Cost of Engineering

Full Data as to What Each Man Is Doing and Cost of Each Job Are Kept in Simple Manner at Boston Navy Yard

A CARD SYSTEM for recording the cost of drafting and engineering, both by man and by job, has been in successful use in the public-works department of the Boston Navy Yard for two years, and is described by Civil Engineer R. E. Backenhus, U. S. N., in the September *Bulletin of the Public Works of the Navy*. The entire record is kept on three types of cards.

The first card is the employee's card. Each employee is assigned a card for his time record for the month. At the top of the card is filled in his name and rate of pay per day. The card is ruled horizontally on each side for the 31 days of the longest months, these days being indicated down the left side of the card. Vertically the card is ruled into seven columns on each side to give space for fourteen jobs. Each job has a number, which is indicated at the top of one of the columns. The money charge against each job is entered in the proper columns against the proper days. In the samples shown by Mr. Backenhus days, half days and quarter days are indicated.

Prefixed to each amount is one of six symbols representing one of six parts into which the engineering work is divided, as follows: SL, surveys and layouts; P, plans; S, specifications; I, inspections; E, estimates; M, miscellaneous. At the bottom of each side of the form each of these six classifications is totaled separately and below all of the classifications is a grand total.

JOB CARDS

At the end of the month the costs are transferred to the proper column on individual job cards. At the top of the face of this card are blanks for indicating the job number, date issued, location and description of work. Below this the card is divided into nine spaces or compartments, three each way. The upper left-hand space is designated "Surveys and Layouts" and shows when they were ordered, to whom they were assigned, when they were completed and the total cost. Next on the right comes "Plans." Similar information is filled in as to them, and also the dates on which they went to the bureau and came back. In the upper right-hand corner, under the heading "Plans Made," come the file numbers of the plans and their dates. These three spaces are amply deep to allow the entry of a number of plans and also to show assignment of the work to several men.

At the left of the next row of spaces comes "Specifications." In this space are filled in the dates when the specifications were begun, completed, sent to bureau, received back from bureau and printed; also the bureau serial number and the total cost. The center space, "Inspections," gives the contract number—which is the bureau serial number of the previous space—the names of the inspectors and the total cost. The right-hand space, "References," gives the computation-book number, the plan numbers and the number of the letter file.

The bottom row of compartments is not nearly so deep. In the left-hand space, under "Estimates," is filled in the name of the estimator and the total cost. The middle space records miscellaneous costs, and the right-hand space gives the date of completion of the job.

On the back of the card is a summary of charges against the job. For each month the charges against each of the six divisions of the work are carried vertically and those against men horizontally, with totals each way and a grand total in the lower right-hand corner. As it would not be possible to carry a complete summary of a large job on one side of such a card, a third set of card forms has been printed, with summaries on both sides.

Separate standing job numbers are given to general drafting-room jobs, such as photographic work, blueprinting, filing, cement testing and the like; also to time off for various reasons.

ADVANTAGES OF SYSTEM

Five advantages, as follows, are claimed for the system:

1. The total cost of plans, specifications, inspections, etc., for each job is given to date at the end of every month.
2. The completed records form a good basis for estimating the cost of engineering or drafting on smaller jobs.
3. The records give accurately the cost of inspection on contract work and give as well the distribution of this cost, which is of value on contracts that have extended beyond the contract time of completion.
4. The records give in detail the disposition of the time of each man. This is of value as a part of the man's record
5. The system shows each man just how he has been spending his time, and he can determine for himself whether it has been profitably expended or otherwise, and it has thus been an inducement to pay attention to this feature.

Brooklyn Marginal Railroad Dropped

Until the problems of the West Side freight improvement in New York City are settled nothing further, it is stated by the comptroller's office, will be done about the Brooklyn marginal railroad.

Country Roads Protected Cheaply from Scour

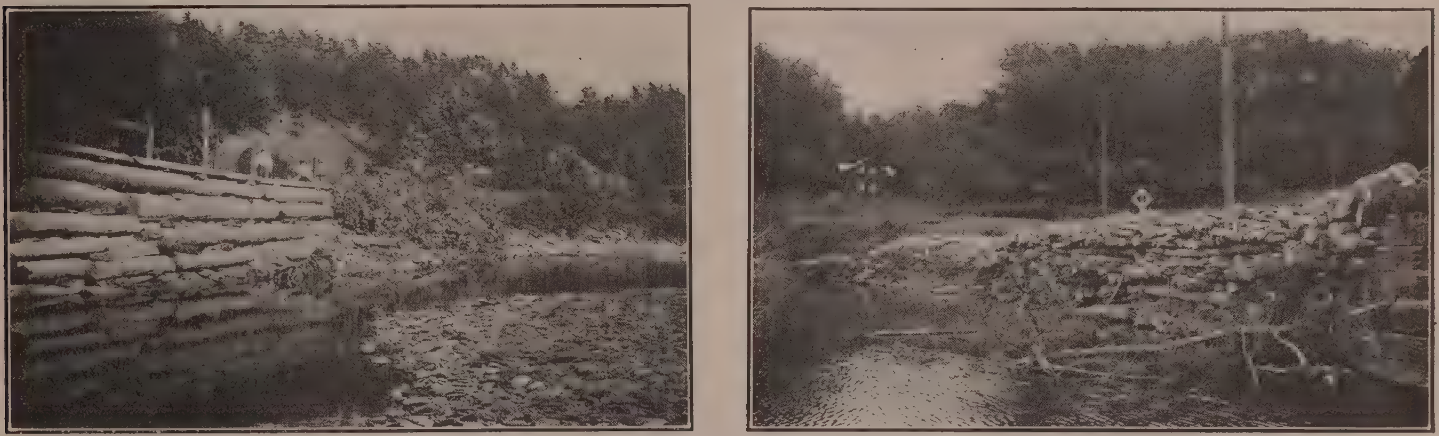
Tree Trunks, Piling, Brush and Stone Have Proved Effective and Economical Defense Against Streams

By GEORGE E. SCHAEFER

County Superintendent of Highways, Geneseo, N. Y.

COUNTRY HIGHWAYS of to-day are the outgrowth of old Indian trails. As the course of the original trail followed the line of least resistance, so to-day, and particularly in the region of mountain streams and tributaries of great velocity and fall, we still find many sections of road too close to waterways, and seriously susceptible to scour and wash.

A large mileage in such locations cannot be changed and must, of necessity, be as adequately safeguarded for traffic as the funds of the community will permit. The prevalence of rugged territory usually typifies a decreased population and therefore a correspondingly lessened assessed valuation of property and a minimum amount of highway funds. And furthermore, for a number of reasons these streams frequently change their courses, and where bank protection was necessary before, it becomes useless unless the stream returns to its former channel. Finally, for financial reasons and otherwise, the more expensive construction, such as concrete and steel sheeting, is eliminated and only cheap local materials utilized.



LOGS IN HORIZONTAL LAYERS AND BRUSH AND STONE MATS ARE EFFECTIVE AND ECONOMICAL

TREE TRUNKS EFFECTIVE

Where the subsoil is of rock a good type of construction for bank protection and to prevent scour is of tree trunks or logs laid in horizontal layers parallel to the stream, with laterals running at right angles to them back into the roadway at distances of 5 or 6 ft. These are bolted or dovetailed to the stream logs, and are locked securely under the highway with deadmen or with dowels. A heavy fill of brush and stone is then placed back of the sheeting. This type is very economical where logs and rock are abundant.

In unstable soils good results have been obtained by driving piling along the bank, preferably staggered, and filling in between the piles with green brush and stone in alternate layers. The brush should not be thrown in haphazard, but placed evenly, and the more the better. It should skew with the stream—that is, be at an angle of about 45 deg. downstream. Care should be taken to procure green brush and have enough rock on top to hold it down.

Piling in straight lines sheeted with planking has not given as good results in this county as that staggered with brush and stone, for the reason that the planking cost is excessive and the earth back of the sheeting invariably washed out from underneath, with resultant caving in of the roadway. Where the velocity of the stream is very great, and large quantities of débris come down, it is sometimes necessary to wire piling together and also to wire it under the highway.

WILLOW BRUSH BEST

Good bank protection can also be acquired with brush and stone alone, skewed downstream and placed in alternate layers as with piling. Willow brush should be used if possible, and large rock. In a great many cases the willow takes root, eventually forming a natural protection.

Another type giving good results is practically of corduroy construction, layers of logs bound together and lying at right angles to the stream, or better, pointing slightly downstream. These should also be interspersed with brush and well weighted down above the water line.

Baffle dams or water breaks of piles, brush and rock are also used at curves in the stream and just above weak spots in the bank. They jut out into the stream on a downstream skew to about the center, and by driving the water to the opposite side tend to protect the bank at the curve or at the weak spot.

Many roads in this section are protected in this manner, and at very low cost, due to the most of the materials being acquired gratis. If well built, they answer the same purpose as concrete or steel sheeting.

Prepared Blocks and Wedges Speed Up Track Leveling in Street

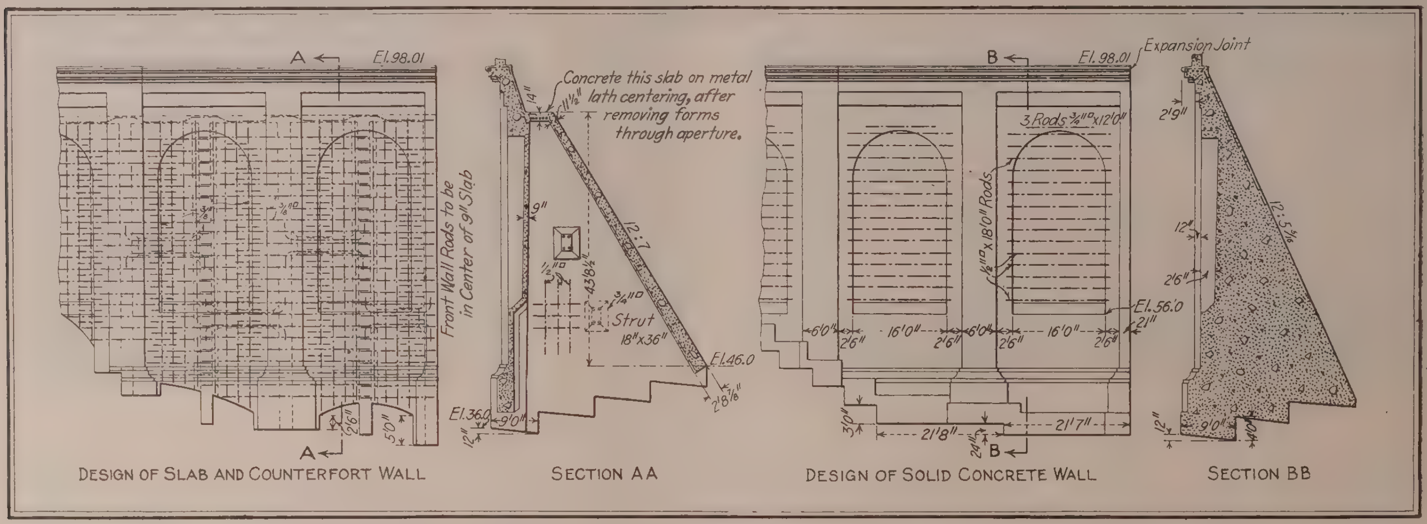
Prepared blocks and wedges were used instead of ordinary rough material in leveling track on the lines of the Northern Ohio Traction Company at Akron, Ohio, states the *Electric Railway Journal*. In the construction work the rails were laid on International twin steel ties embedded in concrete—the foundation for the paving brick. The special hardwood blocks and wedges employed, which were found to facilitate the leveling work materially, were made by the Steele-Alderfer Company, of Cuyahoga Falls, Ohio. The blocks were 6 x 8 x 8 in., while the wedges were 2 x 4 x 8 in., tapered on one side.

Design of Bensalem Avenue Bridge Governed by Architectural Requirements of Site

Contract Let for Important Arch Structure in Philadelphia to Contain Massive Pylons and High Retaining Walls—Alternate Designs Compared

By JONATHAN JONES
Assistant Engineer, Division of Bridges, Department of Public Works, Philadelphia

THE city of Philadelphia has recently awarded the contract for a concrete bridge which will rank next in that city to the Walnut Lane arch, which when constructed in 1908 was a pioneer in ribbed-arch construction in concrete. The new bridge is to carry Bensalem Avenue over Pennypack Creek and the Pennypack Park drives, and when completed will become a part of the transcontinental or Lincoln highway connecting Philadelphia and New York. On both banks of the stream, for several miles in each direction, the city has acquired the land for the development of what is destined to be one of the most important of its parks, and the architecture of the bridge has accordingly been considered of prime importance.



PROPOSED DESIGNS OF SOUTH RETAINING WALL—COUNTERFORT VERSUS GRAVITY TYPE

The general proportions of the structure were carefully studied in elevation and perspective, from viewpoints in the valley and on the roadway, and tested for reasonable economy before being finally determined upon. The resulting elevation presents three elements: (1) The principal bridge structure of three semicircular spans—a central span of 100 ft. clear width crossing the stream and two side spans of 60 ft. clear width, allowing for any desired development of park drives, footpaths, etc.; (2) the approach retaining walls extending practically across the valley, it being deemed inadvisable from the park standpoint to shorten the walls for economy, to intrude 1½ to 1 or similar slopes into the natural contours of the park and to sacrifice the old timber on the south approach; and (3) massive pylons separating the bridge structure from the retaining wall approach.

DESIGN OF ARCH SPANS

Solid spandrels for the arch spans were from the outset considered desirable to give a massive effect. These were designed as gravity sections of solid concrete, with a base width of 0.45 times the height, according to Philadelphia practice. Several different designs were worked up for comparative estimates, including designs which dispensed with the earth filling, thinned the spandrels to bearing walls and by interior piers or columns supported a roadway slab, and including designs which employed the earth filling but balanced the earth thrusts by means of transverse ties from one spandrel to the other. None of these schemes, however, showed any certain economy that would compensate for its complexity or for sacrificing the unlimited pipe and duct space afforded by the unobstructed earth-fill. If the bridge were less wide this result would not obtain; it is because the cost of the spandrel walls is spread over about 80 ft. of bridge width that they do not show up badly in cost per square foot.

The 60-ft. arches are of the solid-barrel type, but with a saving of material in the piers and abutments by the use of buttresses in the latter and cross-walls in the former. For the 100-ft. arch a small and problematical saving, certainly not $1,000, was estimated for a construction of six ribs with reinforced slabs spanning the spaces between them. At even an equal cost, however, this construction was preferred as to appearance, for it conveys the sense of direction of the principal span, while the smooth soffits of the side arches emphasize the transverse direction, which is the direction of park travel through them. A separate price was taken for the waterproofing of the extrados of all arches with asphalt mastic, and as a favorable price was received, this will be ordered.

MASSIVE PYLONS AND RETAINING WALLS

The pylons flanking the arch structure have strong projections from the general surface of the bridge, and are built hollow, with a vertical slab in the rear transmitting the earth pressure to the side or buttress walls. Being hollow, the pylons lend themselves to a number of possible future uses—for storage rooms, comfort stations and other park purposes, perhaps a stairway from the upper to the lower level. Doorways and windows are therefore incorporated in the architectural treatment.

The high retaining walls possess possibly the greatest interest as regards both design and the conditions of the contract letting. Walls as high as 60 ft. at the highest point naturally promised considerable economy through the use of reinforced concrete rather than the gravity type, especially since access to the bridge site is not easy and the cost of hauling is adverse to the type of design that uses the greater quantity of material.

The question of design is, however, inseparable from the question of architecture and of surface finish. Concrete is regarded as an acceptable substitute for stone in the construction of bridges in Philadelphia only in so far as it can be given an acceptable texture and color, either by the scrubbed or Quimby finish, or by bush-hammering and chiseling. In either case, a desirable surface requires a facing mixture different from the body concrete, using a small aggregate of ¼ to ⅜ in., either of stone chips or pebbles. For the Bensalem Avenue bridge it was felt desirable to set against the green trees and meadows of the surrounding landscape a warm buff color, which has several times been obtained by the scrubbing method, using brown and yellow pebbles, locally procurable for the aggregate of the facing mixture. Previous experience with facing mixtures in high thin walls has shown that from 3 to 3½ ft. of thickness is absolutely necessary if the workman is to obtain a uniform and acceptable surface and prevent the backing mixture from working to the face in unsightly patches. This is particularly true when the reinforcement is at all heavy and near the face.

ALTERNATE DESIGNS OF WALLS

For the design in reinforced concrete of the usual slab, platform and counterfort type, it was therefore required that the slab should have a least thickness of 3 ft. 3 in. to allow proper manipulation of the facing. Under this restriction as to amount of material, and using reasonably higher unit prices to allow for the slower and more difficult placing and the probable working of the mixer at less than its capacity, the difference in cost of the reinforced wall was only slightly in its favor.

Further consideration led to a design in which the facing mixture was in general the only mixture in the face wall, so that this wall could be poured from above with no necessity for keeping it separated from any backing mixture. A thickness of 9 in. was adopted for this face wall, and it was of course excluded from any other duty than that of rendering the desired appearance. The earth pressure was to be resisted by a reinforced, inclined slab, back of and independent of the face wall, and carrying its strains by horizontal reinforcement to counterforts. The front faces of these counterforts would require facing, and were designed of ample dimensions for this purpose.

Such a design gives high toe pressures, as the width of base is the width only of the counterforts, the face wall being arched up so as to take no foundation pressure and hence develop no cracks. In the present instance, the presence of hard rock near the surface makes these toe pressures entirely permissible. The apparent advantage of such a wall is that the slab which actually resists the earth thrust can be built speedily in large sections, and with rough forms. If eventually leaks should develop at construction joints, they would be in joints parallel to the main reinforcement and would rust out only a rod or two adjacent to the joint, doing no great damage. Seepage through such joints would not reach the showing face because of the gap between.

ARCHITECT'S SKETCH INDICATES THE PRINCIPAL FEATURES OF NEW ARCH BRIDGE

Comparison of Cost Estimates and Bids

Cost estimates indicated that such a wall would be considerably cheaper than the usual counterfort type, allowing for the additional forms and deducting for the reduction in earth fill. It promised to be several thousand dollars cheaper than a gravity wall of 0.45 base width, which was of course the criterion for stability used in the reinforced designs. It was felt, however, that such comparative estimates on so large a structure should be checked by the taking of actual bids, and therefore the gravity design was advertised in competition with the hollow design. Five bidders submitted proposals, and of these two favored the reinforced design, while the three others bid lower on the gravity type, one by as much as $21,000. Bids received at this particular time hardly establish any generalities, however, as the diversity of opinion among bidders is shown by the discrepancy of nearly 100 per cent between the high and low bids received. There was a difference of about 20 per cent between the lowest and second bid.

The contract was awarded to Day & Zimmermann of Philadelphia at an aggregate price of about $200,000. The contract includes such a diversity of items that it is impossible to compare this price directly with other bridge prices. It represents about $4.15 per square foot, including the fill in place, without paving. As the difference in bids on the retaining walls was small it has been decided to construct the gravity type.

This contract is under the direction of George E. Datesman, director, Department of Public Works, city of Philadelphia, and Chester E. Albright, chief engineer of the Bureau of Surveys. The writer, as assistant engineer in charge of the bridge division, is directly responsible for design and construction.

Describes Sheet-Pavement Problems in St. Louis

J. L. Laxton, Engineer of Bituminous Roadways, Tells Reasons for Potholes and How to Mend Service Cuts

CROWN, gradient, traffic, and extremes of temperature, in their effect on the maintenance of sheet pavements of St. Louis, were discussed in a paper recently presented to the St. Louis Engineers' Club by J. L. Laxton, engineer of bituminous roadways. The following notes are from this paper.

The crown of the roadway, being intended to dispose of surface water, it follows that the greater the crown the easier it will be to prevent small pockets of water from standing on the surface. It is inadvisable, however, to exceed a 6-in. crown on a standard-width roadway of 36 ft. owing to the tendency of vehicles to skid when the pavement is wet or has ice on it. This condition becomes aggravated on a pavement that has "dried out." These little pools of water are highly detrimental to the surface of sheet pavement because of the suction-pump action that takes place when the wheels of a rapidly moving vehicle pass through them, displacing the finer particles of the surface and creating a pothole through which water soon gains access to the concrete foundation and begins the work of destruction through disintegration of the asphalt.

The gradient of the street governs to a large extent the tendency of a ductile material to "shove" or form undulating waves transverse to the roadway. On a roadway having very little grade in it the tendency is for these waves to remain permanent or to become more aggravated. It is therefore necessary to remove such material and replace it with new. On a roadway having a material gradient there seems to be a greater tendency for these wavy places to iron out through the action of traffic. This opinion is based upon the fact that there is no trouble from "shoved" spots where there is an appreciable gradient. Maintenance costs are also lessened on a street having a gradient, since it assists in the removal of surface water, thus preventing the suction-pump action.

Traffic Needed to Knead the Pavement

Under traffic the surface is subjected to severe abrasion and mineral particles are exposed, loosened and swept away. This raveling process assists in the formation of potholes mentioned previously. To this extent traffic is detrimental, but it is highly beneficial through the kneading process, commonly referred to as "ironing," which keeps the pavement plastic. A sheet pavement with no traffic deteriorates about as fast as one subjected to heavy traffic. The lack of traffic assists the rotting action of water, street liquids, and escaping gas, because this condition helps the volatilization of the lighter oils, with a consequent hardening of the remaining bitumen. The pavement is thus rendered porous, and its ability to withstand the strains and stresses set up by expansion and contraction is reduced. In the course of time the pavement loses so much of its plasticity that it cracks during periods of low temperatures. Generally speaking, temperatures affect the various bitumens in much the same way.

Mending Holes

The method followed by the city in curing potholes is to remove the injured material with a square shoulder, going far enough back to get into good material; paint the edges of the cut with a cut back A. C. paint; place new material, tamp and roll. On repairs due to wear and tear this method is very efficient. The greatest difficulty experienced in St. Louis in making repairs is on service cuts, which are rarely tamped as they should be, and continue to shrink after the repair is made. An effort is made to let these cuts settle at least thirty days, but on prominent thoroughfares it is frequently found necessary to make the repair in less time. The department is also criticised for going back on a cut far enough to secure a shoulder on solid material. This is absolutely necessary in order to make the work as nearly permanent as possible. In other words, the criticism arises from the necessity of making the repair slightly larger than the neat lines of the cut.

The costs for repairs and maintenance of 2,056,228 yd. are approximately as follows: Maintenance per square yard per year, 9 cents, including straight burner resurfacing (plant mix) at 60 cents per square yard; straight patching wear and tear (plant mix), 81 cents per square yard, and straight flush coating on bitumen, 2½ cents per square yard.

Light Concrete Approaches Prevent Bumps at Bridges

Under the usual earth approaches at the ends of bridges Washington County, Oklahoma, has placed light concrete approaches 4 ft. long. The concrete slopes downward from the edge of the bridge floor at an angle of 45 deg. In case traffic and weather action remove the earth near the ends of the bridge floor the concrete still remains to shield the drivers of automobiles and other vehicles from the bumps that they would otherwise encounter. This precaution is said to eliminate such annoyance.

Safe Design Depends on Validity of Assumptions Underlying Theoretical Analysis

Professor W. M. Wilson, in Address Before Western Society of Engineers, Incidentally Points Out Lessons Taught by Second Quebec Bridge Disaster

THAT QUALITY of design is not proved because a structure has not failed, that good engineering is the best insurance against failure and wasted material is a tribute to ignorance, that higher safety factors should be used for small critical parts upon which the success of a whole structural operation may depend, that incorrect assumptions for theoretical analysis may cause serious failure, that secondary stresses (and the best frames to avoid such stresses) should be considered, and that tests are required to furnish more exact knowledge of the behavior of truss frames—all these points were given striking emphasis by W. M. Wilson, assistant professor of structural engineering, University of Illinois, in an address before the Western Society of Engineers on Oct. 9. The second Quebec Bridge disaster was cited as an example of the use of too low a factor of safety in a small part the failure of which would destroy the whole structure. The following short extracts have been taken from this address:

CRITERION OF GOOD DESIGN

"The fact that a structure has not failed is not proof that it was properly designed. Structures are generally designed with a factor of safety of about 2, based upon the elastic limit. The fact that the structure has not failed is evidence only that all members have a factor of safety of at least 1, and there is no evidence to show that some members do not have an excess of material. If a design is good because the structure does not fail, the design of the ancients should be copied, whereas they are known to be so wasteful of material as to be prohibitive.

"For a design to be good it must be well balanced. Although a structure must be safe, it also should be economical. In stating that a structure must be well balanced I do not mean that the ratio of strength to stress necessarily shall be the same for all members. Many other factors besides strength must be considered. If the failure of a small part will destroy a whole structure, the factor of safety in the small part should be greater than the factor of safety for larger or less critical parts. This is illustrated by the second Quebec Bridge disaster.

"Because of saving in shop costs it is sometimes cheaper to build a member that is too large than it is to build a member that will just carry the load to which it is subjected. Because of the small amount of material involved it is often cheaper to use an excess of material than it is to make an exact analysis of the stresses. An increase in the live load may cause a much greater increase in the total stress in one member than in other members of the same structure; therefore if there is a possibility of an increase in the live load such a member should have a greater margin of safety in the original design than other members of the structure. Although it is good engineering to make some members of a structure larger than stress alone requires when there is a definite object to be attained, it is not good engineering to make a member unnecessarily large because of ignorance of its true function.

"Good engineering is the best insurance against failure; wasted material is a tribute to ignorance.

DESIGNING NOT SOLELY MATHEMATICAL

"It is not true, as the beginner is likely to believe, that the design of a structure is made up only of exact mathematical processes, and that the results are therefore infallible. In general, with known forces acting upon a structure the stresses are determined mathematically. The thing that has been entirely overlooked, however, is the fact that for every mathematical equation used assumptions have been made in deriving the equation, and these assumptions have been entirely neglected in applying the equation. The accuracy of the results depends not only upon the accuracy of the mathematical processes, but also upon the accuracy of the assumptions upon which the mathematical processes are based.

INCORRECT ASSUMPTIONS

"The assumptions which enter the design of a bridge and demand special attention on the part of the designer refer to the following: Secondary stresses, distribution of stress in a member, and distribution of stress in a connection.

"One of the fundamental assumptions in stress analysis is that connections are frictionless hinges. If a truss having frictionless hinges is deflected, the members meeting at a joint are free to rotate relative to each other and no bending stresses are produced in the members. If, however, the connections are rigid, when a truss is deflected the members are not free to rotate relative to each other, and bending stresses, known as secondary stresses, are produced. These secondary stresses can be determined mathematically. While all are willing to admit that, theoretically, secondary stresses exist, many—apparently because of the elaborateness of the calculations necessary for their determination—look upon them as something invented by the mathematician for the further torture of the soul of the engineer. The strain gage, however, has come to the support of the mathematician and secondary stresses are known to be a reality.

SECONDARY STRESSES

"The calculation of secondary stresses is a long and tedious process, but like all long processes it shortens with repetition. The design of short and medium length spans has been standardized; and if the secondary stresses are computed in a few of each of the common types of trusses, may we not hope to establish empirical laws by means of which the secondary stresses in other trusses may be determined in a comparatively short time? Thus it would be possible to design all members with approximately the same factor of safety after secondary stresses have been included.

"The resulting more perfectly balanced design would be a sufficient reason for making an extended systematic study of secondary stresses in standard trusses. There are, however, other results to be obtained from such a study which are even more important. A more intimate knowledge of secondary stresses would result in the abandonment of types of trusses having high secondary stresses and the substitution for them of trusses having low secondary stresses. An illustration of this is to be found in the attempts to use the K type of truss of the Quebec Bridge for shorter spans. Moreover, being confronted with high secondary stresses, the engineer would exercise his ingenuity to devise details which would reduce the secondary stresses. This is illustrated by the recent use of pin connections between the floorbeams and trusses to reduce the secondary stresses in the vertical posts of trusses.

"It is the writer's opinion that for ordinary working loads the stress at the end of a member is not uniformly distributed over the section, and that the maximum unit stress is materially greater than the total stress divided by the area of the section. Furthermore, it is the opinion of the writer that ultimate failure of many members connected as they are in bridges will occur at a stress materially below the ultimate unit strength of the material multiplied by the area of the section of the member. Since the advent of the strain gage the first statement can be either verified or disproved by means of field tests of bridges under normal working conditions without a prohibitive expense. The second statement can be checked by tests to destruction.

TESTS NECESSARY

"The important thing to be revealed by such tests is the efficiency of the different types of sections. If a member having one section can develop a stress of only 80 per cent of the product of area times unit strength of material, whereas if the member had a different type of section it could, because of the better type of connection possible, develop 90 per cent of this product, then, other things being equal, the latter type of member should be used. At present we have but little, if any, reliable data relative to the efficiency of connections for different types of members. We have many opinions, but few facts.

"The thickness required for gusset plates is another question that has no satisfactory answer. Some designers claim that a truss can be assembled with only 25 per cent for details; other designers use 50 per cent. The American Bridge Company states that its trusses run about 33 per cent details. As gusset plates comprise a large part of the details, the percentage of details depends largely on the thickness of the plates. The thickness of the plates cannot be computed except that the strength of the rivets in bearing should develop the strength of the rivets in shear. Usually the plates are thicker than is necessary to meet this requirement. The outstanding fact is that the weight of a truss can be materially altered by changing the thickness of the gusset plates, and we have no positive evidence determining the proper thickness. We have opinions, of course, but the man who assembles trusses on 25-per cent details is positive that any one using more than 25 per cent is wasting material, whereas the man who uses 50-per cent details is positive that any less than that endangers the structure.

"In general, in judging of the merits of a connection it is well to bear in mind that the main member is the major part and the connection is the minor part, and that it is not good logic to jeopardize the major part to save a little on the minor part. Furthermore, if the life of a bridge is determined by the time it will wear as a machine it will be the connections that will wear instead of the main members. For this reason also the connections should be stronger than the members.

"The whole question of the strength of connections is a field ripe for experimental investigation."

Derrick Breaks and Drops Section of Boiler Stack

Twisting Moment on Head Produced by Eccentricity of Guy Connections Probable Cause of Failure

By HENRY BLOOD
Engineer, Bureau of Buildings, Portland, Ore.

CAUSED by the breaking of one leg of the A-frame, apparently due to excessive twisting moment, a derrick used in hoisting the top section of a steel boiler stack collapsed and dropped the 6700-lb. load a distance of 145 ft. to the roof of a two-story wing of the building. The accident occurred on Aug. 30, when the last section of an addition to the height of the Northwestern Electric Company's 10-ft. 6-in. stack on the Pittock Block, a 200 x 200 ft. reinforced-concrete office building eight stories high, was being placed in position. This addition of 50 ft. to the height of the stack was being made to abate the annoyance to tenants of a neighboring office building caused by the smoke.

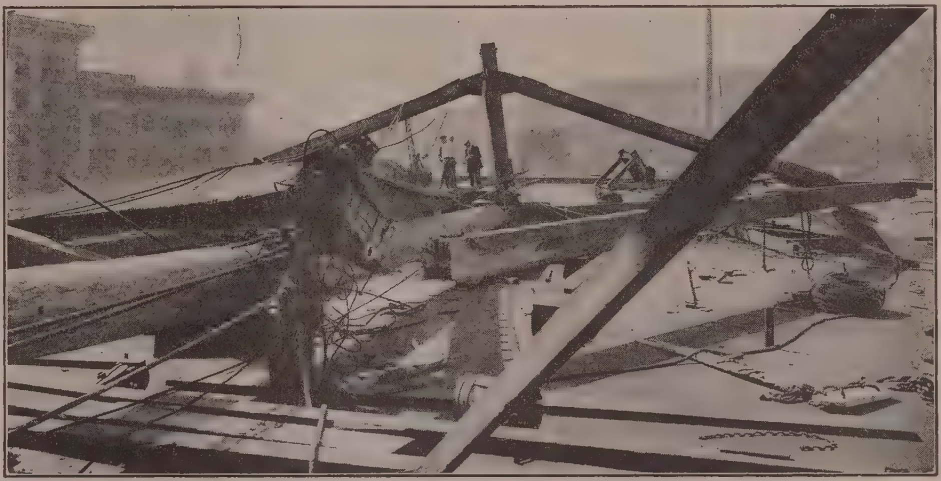
DESCRIPTION OF DERRICK

The derrick had an A-frame composed of 14 x 14-in. Douglas-fir timbers, with a vertical height of 45 ft. and spread of 50 ft. It had no stiff legs, but was guyed to the roof with two sets of steel cables, making an angle of 60 or 70 deg. with each other, extending back about 50 ft. from the derrick, and fastened through holes cut in the roof slab around concrete girders. The base had a timber under each leg, connected by poorly made joints to a short girder built up from I-beams, with top and bottom plates, to form a seat for the boom. Back of this sill there were two diagonal timbers and a center strut 12 ft. long. The boom was a single stick of Douglas fir 106 ft. long, of 14 in. diameter at the top and 22 in. at the bottom. It worked on a vertical pin of 4⅛ in. diameter. Its weight with fittings was about 6600 lb.

The legs of the A-frame were connected at the top by two wide steel plates 4 ft. 9 in. long. The front plate was ⅜ in. and the back plate 5/16 in. thick. The lower corners of the back plate were cut off, so that they did not extend as far down the legs as the front plate. A large number of bolts, generally ¾ in., joined the plates and legs, some being below the back plate. A heavy forging with an eye in each end passed through the plates near the top. The center of the front eye was 2½ in. from the face of the plate; that of the back eye about 5 in. The boom guy, a six-part ¾-in. steel cable, was fastened by a link and clevis of 2¼-in. metal to the front eye. The backstays were attached by a horizontal pin and shackle. The running line from the boom guy passed through a block held by a U-bolt near the bottom of the front plate. A side guy ran from the end of the back shackle to the east wall to take the strain when hoisting from the street over the west wall. All cables and connections appeared amply strong for the loads. The superintendent stated that the derrick was designed to handle 36 tons at an elevation of 30 deg.

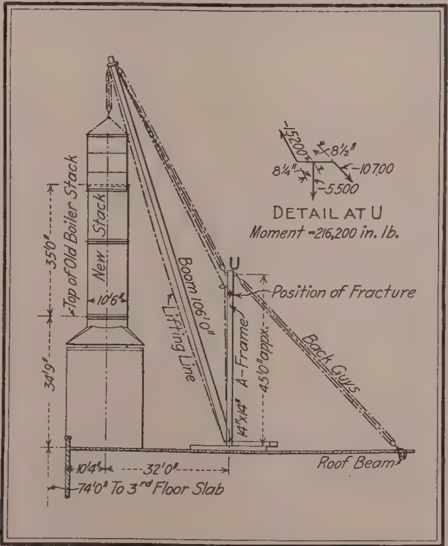
HOW FAILURE OCCURRED

Two engineers of the Northwestern Electric Company were on the roof watching the work and observed the failure, which was caused by the west leg of the A-frame being twisted or torn off just below the top connection. The boom fell in a vertical plane toward the north, struck the fire wall, and broke off a few feet outside. The broken end, which was about 40 ft. long, fell close to the wall, the top end punching a hole through the wood roof about 25 ft. from the wall, and the broken end leaning against the wall at a window. The blocks swung violently against the wall, smashing windows at the fifth, sixth and seventh floors in the second row from the west corner. Several workmen and employees in two or three offices had narrow escapes.



VIEW OF WRECKED DERRICK SHOWS THE BROKEN LEG OF A-FRAME

The derrick kicked backward, not being fastened to the roof, struck a corner of the fire wall, and was turned toward the west. The base timber broke off near the east leg.



BOOM AT HIGH ELEVATION JUST BEFORE ACCIDENT—TWISTING MOMENT COMPUTED

No cable connections were broken. The accompanying photograph, taken the next morning, shows clearly the nature of the break and the position of the fallen derrick.

The broken timber was not entirely sound, but no real decay was visible. It was seriously weakened by the bolt holes. There were three ¾-in. holes in a transverse row and two more only 2½ in. from them at the point of failure. The wood broke through all five. There was an old crack or check about 2 in. from the outer face, extending for some distance along the fibers, which may have been caused by some previous strain. But even with these defects the stick was safe for a much larger direct load than existed at the time of failure.

In my opinion the break was due to a twisting moment on the derrick head produced by eccentricity of the guy connections. This was not nearly so large when the boom was at a moderate elevation as when it was in a high position. It was elevated at an angle of 70 or 72 deg. from the horizontal at the time of the failure. As indicated in the sketch, there would be considerable twisting in this position, which would cause tension in the front face of the legs. The connection of the boom lifting line to the bottom of the front plate increased this eccentric action, adding to the direct tensile stress in the leg.

But the heaviest twisting moment could have occurred when the boom was swung to the west to hoist from the street. It was then nearly parallel to the front of the A-frame, and its guy formed with the side guy from the east wall a couple having a lever arm of 26 or 27 in. The leg may have been slightly cracked by this strain, and so weakened that when the boom was in its unusually high position it easily failed.

It is quite unlikely that there would have been a failure if the top connection had been designed to avoid eccentricity with the load in any position, and if the side guy had not been attached to the back shackle. This is a detail that should receive more careful consideration. Derricks, hoists, scaffolding, and other erection equipment should have proper design and inspection, as well as more permanent structures. They need not necessarily have the same factor of safety, but they should be sufficiently strong to avoid risk, and the details should not be weaker than the members they connect.

Letters to the Editor

Comment on matters of interest to engineers and contractors will be welcomed

Lime and Cement vs. Cement

SIR: A little over a year ago I built for Broadacres Dairy Farms at Orangeburg, N. Y., two concrete silos, each 37 ft. high and 16 ft. in diameter, having 6-in. walls reinforced with ⅜-in. square twisted steel bars. Six-foot forms were used, the volume of concrete being about 1 yd. to the foot of height. The concrete was proportioned 1:2:4, the coarse aggregate being crusher-run field stone up to 1½ in., with the dust removed.

The concrete was hoisted in a tower and chuted from this to the forms. In the first silo no lime was used, and the concrete had to be mixed watery to flow into the narrow forms and around the reinforcement. In the second silo one shovel of hydrated lime was used to each two-bag batch, making the proportion of lime about 5 per cent of that of cement. With this the concrete was mixed to a cream-like consistency, and flowed readily from the chutes and around the steel, giving a good surface against the forms. By reason of the drier mix the forms could be removed considerably earlier, thus allowing a shift a day.

Without the lime I had difficulty in getting the forms tight enough to prevent leakage of the watery mortar, with the consequent honeycombed surface. The mortar would also separate, the mortar chuting quickly into the forms, with the separate stones of the aggregate tumbling slowly after. With the lime the concrete slid slowly into place, keeping its consistency throughout, and requiring little spading.

Recently the concrete of both silos was cut into in attaching a building to them, and I could not detect any difference in hardness of the concrete in them; but that of the silo in which the lime was used showed a more uniform distribution of the coarse aggregate.

In this case the cost of concrete materials was increased by the cost of the lime; but the foregoing appears to indicate that the lime could replace some of the cement without injury to the concrete, thus making the cost of materials the same or less, while reducing the cost of placing.

R. M. CREAMER.

Orangeburg, N. Y.

Prepared Mortar as a Cure for Present Carelessness

SIR: Experienced engineers know that a structure is not superior in strength to the material of which it is built, and that a wall can be no stronger than the mortar which binds its parts together. This then brings us to the question of failures of brick masonry that have been reported in your columns during the past few weeks due to more or less common poor but often expensive practices of some engaged in the contracting business.

I make particular reference to the abuses of such well-known standard materials of construction as Portland cement and lime. In your issue of Sept. 2, on page 294, is printed Sanford E. Thompson's report of the failure of the brick piers in a school building at Roxbury, Mass., in which a direct abuse of the materials just mentioned is given as one of the causes of the failure. On Aug. 28 last a five-story building collapsed in Marion Avenue between East 187th and 188th streets, New York City, killing two and injuring fifteen workmen. Several persons were arrested, charged with manslaughter, it being the opinion that the building was inefficiently constructed and could not stand. One bricklayer stated he had never seen such "rotten" cement. It is safe to say that the cement was up to the standard, but can the same be said of the mortar? On the other hand, it is safe to say that a most flagrant misuse and abuse of cement was committed.

In spite of the efforts to construct building codes to prevent occurrences of this kind, building departments to furnish inspection, etc., still these failures occur from time to time, and after the din of failure has subsided the verdict is "careless mixing or skinning the mortar."

There is nothing mysterious about Portland cement or lime as commonly used in building construction. Both of these materials are manufactured along highly scientific lines by reputable and responsible concerns to pass certain well-known and accepted specifications; and if the manufacturers' instructions are followed in using the materials, they can be depended upon to perform their particular functions. Specifications are written by engineers and architects with known results in mind, and the job is then turned over to the contractor for completion. Unfortunately, however, these standard materials are destined after shipment to be passed to the hands of many who either know nothing about the materials entering into building construction or do know but prefer to disregard all governing conditions to reap big profits upon concluding a contract.

This important subject of the misuse and abuse of Portland cement and lime offers the following solution as probably being the best method to avoid failures such as mentioned: The adoption of a prepared brick mortar, which would be delivered on the building site ready for mixing with water. Such a mortar would carry the following advantages:

1. The mortar would be delivered on the job by a reputable builders' supply concern in packages of convenient size for handling, each package marked with the name of the manufacturer.

2. The reputation of the builders' supply concern would protect the engineer or architect against receiving anything but a suitable mortar.

3. Proportions of cement, lime and sand would be accurately made by weight according to some formula known to give best results from both economic and structural viewpoints.

4. Mixing would be done mechanically for any given length of time to insure thorough distribution of all materials.

5. Every pound of mortar to be used in a building would be of the same identical proportions and would have received the same amount of mixing. Every package of mortar would be the same as the one previously used.

6. The mortar would be ideal for the purpose intended.

It will readily be seen that a prepared mortar such as mentioned would not only make reliable mortar joints but would automatically eliminate the loss of life and property, as cement and lime mortar properly proportioned, mixed and used does not fail.

As to the cost of a prepared mortar of this kind, it probably would not cost more than the mortar as it is mixed and used at present. A ton of prepared mortar would lay 2000 bricks with ordinary joints, and approximately exact quantities of mortar could be ordered for each job. There would be no waste materials. It is not infrequent to find a waste of from 10 to 15 per cent upon screening the sand, and there would be no unused piles of sand after completion of jobs. Taking these items into consideration, and others that enter into the preparation of mortar on the job, a prepared mortar should cost no more than when it is mixed on the job.

Prepared mortar of this kind has been in use in the city of Cleveland for the past two years, and it seems that no new materials introduced into any market could have had a more rapid development than prepared mortar. Engineers, architects and contractors have accepted it as standard practice with the satisfying knowledge that they are using a mortar that is safe, economical and produces "sure-thing" results.

No doubt engineers and architects in all other large cities would be quick to see all the advantages of a prepared mortar of this kind and would standardize it as is being done in Cleveland; and going further, it would probably only be a short time before the first-class cities would make it imperative, through their building codes, that a prepared mortar be used on every job of brick masonry.

HYDRATED LIME BUREAU,
Norman G. Hough, Manager.
Pittsburgh.

Inadequate Compression Members

SIR: A striking illustration of the results of using improperly designed compression members was recently noted by the writer in making an examination of an old steel highway bridge. The bridge in question is of the ordinary light construction still quite common in some sections of the country. It is a seven-panel, pin-connected Pratt truss, 125 ft. center to center of end pins, 22 ft. center to center of chords, and 17 ft. 10½ in. center to center of trusses. The vertical posts or compression members are all built of four 2 x 2 x 3/16-in. angles, laced.

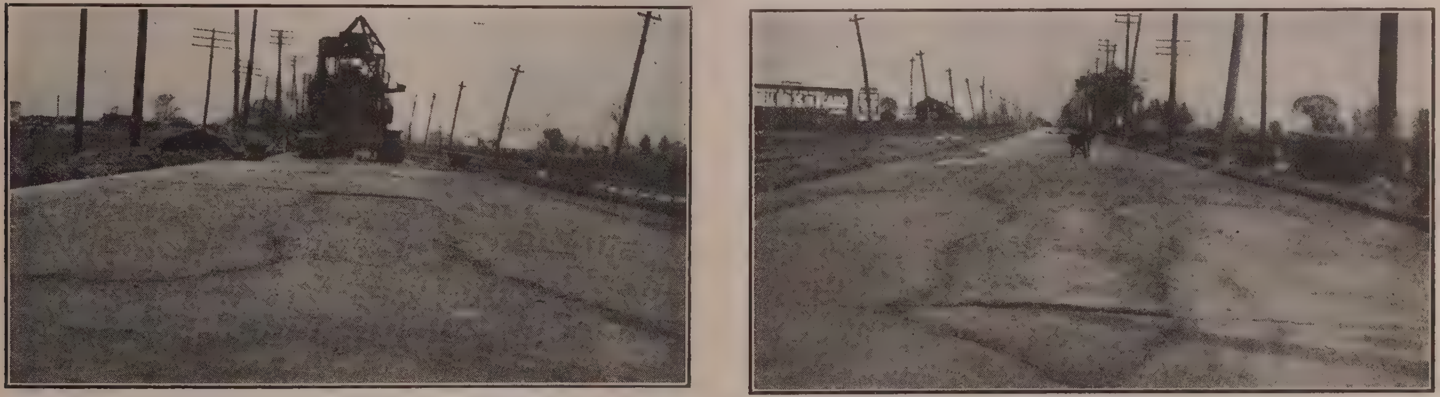
With only one or two exceptions these posts were bowed or buckled to such an extent that the defect was quite noticeable from the roadway of the bridge. Such a defect, if occurring in only one or two members, might reasonably be assumed to be the result of injury to the piece during fabrication or erection, but such an assumption seems hardly reasonable when practically all of the members show the same defect.

It seems to the writer that the cause of the buckling is made quite clear by an examination of the properties of the post section. The radius of gyration about the axis along the lacing is 0.98 in. and the distance between pin centers is 22 ft., making the value of l/r equal to 269. The column formulas usually specified cannot, of course, be applied for such a large ratio of length to radius of gyration, some of the straight-line formulas giving negative allowable stresses. The maximum computed dead-load stress in any post is less than 8000 lb., or 2800 lb. per square inch. The posts have buckled, as would be expected, in the direction of the least radius of gyration and parallel to the axis of the truss.

E. F. Kelley,
Assistant Bridge Engineer, Iowa State Highway Commission.
Ames, Iowa.

Evidence Presented on Wear of Concrete Roads in Wayne County

Sir: The article (page 434) and editorial (page 427) in your issue of Oct. 7, on the resurfacing of concrete roads in Wayne County, Michigan, impose upon me a very disagreeable necessity. We have never exploited the deterioration and repair of Wayne County concrete roads. When, however, the Engineering Record states that "no concrete roads in Wayne County have as yet worn out" it seems desirable in the interests of truth to call your attention to the photographs inclosed herewith. You will note that these photos of Grand River Avenue were made in May of this year. They show the extensive repairs, amounting almost to reconstruction, that were then taking place. Gratiot Avenue, another Wayne County concrete pavement, was at the same time in a similar state of disintegration. Both roads had "worn out" to such an extent that in an automobile one could proceed over them only on low gear and at very slow speed.


PATCHES MADE IN GRAND RIVER AVENUE CONCRETE ROAD OF WAYNE COUNTY SYSTEM IN MICHIGAN

DEFECT IN GRATIOT AVENUE WORK

In calling your attention to these facts, which I think completely disprove your statement that "no concrete roads in Wayne County have as yet worn out," I fully realize that it is possible to point to failures of every type of pavement. I hope, therefore, that I shall not be accused of exploiting the two Wayne County road failures here referred to. I merely wish to correct the statement made in your editorial note.

With reference to the article, as distinguished from the editorial note, it does not give the cost of the resurfacing of Grand River Avenue, which really amounted to building a new concrete road on top of the old one that had gone to pieces. Should I suggest that a better way of repairing the road would have been to utilize the old road as a concrete foundation for an asphalt macadam wearing surface my statement might be taken merely as that of an asphalt advocate. This much, however, is indisputable: The cost of providing a durable 2-in. asphalt-macadam wearing surface would have been very much less than the cost of building a new 3-in. concrete road on top of the old one. Since you have made reference to the cost of the work as done, you may consider it desirable to ascertain just what this cost was, including the repairs made to the old road and the subsequent resurfacing thereon.

D. T. Pierce,
Executive Assistant, Barber Asphalt Paving Company.
Philadelphia.

CONCRETE ROAD CLOSED FOR REPAIRS

Justice to the Contractor

Sir: In your issue of Sept. 9, page 331, J. L. Harrison of Manila has something to say concerning justice to contractors, and in the issue of Sept. 16, page 359, Albert M. Wolf also discusses the subject. Both of these gentlemen have the same idea that is causing contractors so much trouble, namely, that the engineer is right regardless.

To begin with I want to say something regarding the system now practised throughout the United States. When a young man graduates from an engineering school some engineer gives him a job as inspector. You can tell how much he knows by the salary he is paid, usually from $60 to $85 per month. His principal duty is to tell a superintendent (who is probably paid from $175 to $1,000 per month) how much he, the inspector, knows. This boy engineer (?) who has had no experience whatever tells this superintendent whether rivets are driven right, whether timber is good or bad, whether the concrete is being mixed properly, etc. He also gives the superintendent "pointers" on how to carry on the work.

It is the most unreasonable condition existing in any business in this country today. You engineers work on the theory that a man is an engineer when he graduates from an engineering school. He is no more an engineer than is a man a business man when he graduates from a business school. Whoever heard of taking a young man out of a business college and putting him in charge of a bank? Why not? He pursued a business course, with banking and bookkeeping, etc. It sounds foolish, but that is the condition you are forcing on the contractors.

Mr. Wolf lays particular emphasis on the engineering contractor who "carefully analyzes" every bid. I wish we could have secured Mr. Wolf's services to analyze carefully some of our bids this season and make ample allowance for a rainy season, labor shortage, and a scarcity of freight cars. These conditions soon convert a good contract into a losing one.

Mr. Wolf makes a startling statement when he says that the more experience a man has in inspection work the less he is worth to the owner. I think if Mr. Wolf will reconsider this statement he will withdraw it. For my part I know I would rather let an experienced tailor make me a suit of clothes than some graduate from a sewing school.

I want to call a few instances to your attention in which contractors have suffered at the hands of engineers. A few years ago I was working as an inspector under an engineer who "carefully analyzes" things. The contractor was building a parapet wall about 3 ft. 6 in. high on the top of a concrete dam. In one place the wire across the forms broke and the weight of the concrete sprung the forms considerably at that point. The foreman removed part of the concrete and drew the form back as near to place as he could get it. It happened that the engineer was on the job that day (it was too cloudy for him to go fishing) and saw the whole accident. He told me to have the foreman remove that section (16 ft.) I got a level and checked the form and found that it was ¼ in. out of plumb in 3 ft. 6 in., and I refused to make him take it out for that slight difference. The engineer made him remove it, however, saying that anybody would know that that wire was not heavy enough to hold those forms. That same size wire had worked successfully, though, in some 2000 ft. of wall that had been built.

Last season, in laying concrete pavement, we came in contact with some engineering judgment that was quite expensive. The specifications called for a subgrade 5 in. below the top of the forms, to be rolled with a 10-ton roller. We graded the street and rolled it as per specifications, and when we came to laying the pavement the inspector fortified himself with a piece of chalkline and immediately found places where the grade was ¼ in. too high. Anyone who has ever been around construction work knows that dirt cannot be rolled any closer than ¼ in., and there was just as much of it ¼ in. too low as there was too high. I offered to take out any dirt willingly where the average of five readings across the road was less than 5 in. He pulled out the specifications and showed me where 5 in. was called for, and said nothing else would do, and we had to grade over 4 miles of road under such tyrannical inspection.

I know of another case that happened in one of the large cities on this coast that shows what the contractors are up against. In bidding on a job the contractor bid on new curb and on old curb torn up and replaced. There was only 3 ft. of the latter shown on the plans, so he put the same price down for both, as it would have been foolish to waste time trying to figure costs on such a small amount of work. During the course of construction the computers made an error in grade, and after the curbs were in they discovered that one block was a foot too high. They made the contractor tear out this curb and replace it for his price per foot because he bid on tearing out and replacing curb. I was estimating new work for the city at that time, and before bids were called for I protested against taking such an unfair advantage of a contractor; but the engineer in charge of this job thought that was a clever piece of engineering.

A year or so ago a Western state highway engineer, in his yearly report to the governor, showed a novel combination of engineering skill and high finance. In one county a certain amount was appropriated for road construction. The contract was let to a Seattle concern, and after the work was under way the engineer deemed it advisable to change the location, involving thousands of yards of extra excavation. In his report the engineer stated that under the original classification of excavation the county did not have enough money to complete the work, but by changing the classification there was still a balance of more than $1,000 in the road fund. I might say in connection with this that the contractor brought suit, which is still in the courts, for something over $60,000. Such a case as this should be punishable with a penitentiary sentence. Obtaining money by altering the classification of earthwork is not different from obtaining money by altering a set of books.

I could cite a hundred cases equally as ridiculous. As long as this feeling and condition exist there is going to be trouble between engineers and contractors. As long as you engineers start on a job with the feeling that the contractor is a crook you are going to cause yourselves trouble and cost the contractor money, and nobody will be benefited. We in the contracting game do not claim to know it all, but we hate to have some kid with a B.S. degree tell us how little we know. Experienced engineers and inspectors are all we ask for. A give-and-take proposition is fair for both sides, but the way it is at the present the contractors give and the engineers take. We do not care what the specifications are with a fair engineer. We bid on doing the work right, and that is all a fair and experienced engineer will ask of us.

Portland, Ore. J. T. CARMICHAEL.

[In justice to the "boy engineer" it should be noted that in three of the four examples cited by Mr. Carmichael the offenders appear to have been engineers of more mature years. Unquestionably "kid" inspectors with the B.S. degree do often outrage engineering common sense, but their complete elimination would hardly settle all difficulties between engineers and contractors.—EDITOR.]

Eccentric Loading on Columns

SIR: I have read with interest the article in your issue of Sept. 2 discussing "Eccentric Loading on Columns" and the comments in the issue of Sept. 30. The article has special reference to columns in mill buildings and gives equations for the moments and reactions on such columns where subjected to eccentric loads from traveling overhead cranes.

The assumptions made in working out the above are erroneous in the following particulars: It is assumed that the roof truss is so held at its opposite end that it prevents any horizontal movement at the top of the column, while as a matter of fact all that holds it is a column exactly like the one under consideration (except in some special cases) and which deflects exactly as much, due to the force R_t. The only condition under which there would be no deflection at top of column, where both columns are alike, would be that of the crane load at the center of the crane as in Fig. 1 herewith. As the load may be at either end of the crane the condition for any mathematical discussion should be as shown in Fig. 2. Under such conditions it is obvious that hinged ends at both ends of the columns would result in collapse.

As a great many columns carrying crane runways are constructed with a much smaller section above the girder seat than below, the moments of inertia of the two sections are quite different and should be considered in working out any table for use in design.

The article in question states that "it is better to avoid eccentricity than to make provision for it. When practicable, columns as in Fig. 4 should be used." The crane load in Fig. 4 is certainly eccentric, as the neutral axis is some distance from the edge of the column on which the girder rests, although the bending is much less than that in a thinner column carrying the crane girders on a bracket.

It should be borne in mind that a great many mill buildings are built with side bays that so hold the main columns that the conditions become too complex to allow a satisfactory analysis, and when the condition is further complicated by the addition of swinging jib cranes and the consideration of lateral impact from any of the crane loads, it devolves upon the designer to make a reasonable assumption as to what factors to ignore, and to use conservative unit stresses.

It would seem proper when the crane loads cause flexure which, if combined with the direct compression, does not cause tension in the anchor bolts, to regard the base of the column as fixed, but unless the roof truss is quite deep at the ends the top should not be so considered. A truss with no end depth, as in Fig. 3 of your issue of Sept. 30, page 419, where the top and bottom chord members intersect about at the center of the columns, does not offer much resistance to flexure and cannot be regarded as "fixing" the end of the column. The large gusset plate simply transfers the moment to the individual members of the truss, which members are generally small as compared with the column section, and deflect too much under flexure to offer a restraining moment of any great amount.

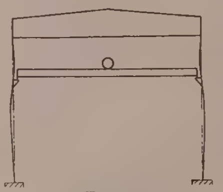


Fig. 1

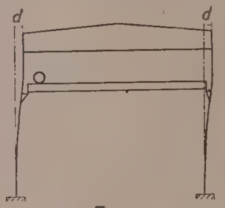


Fig. 2

HOWARD C. BAIRD,
Boller, Hodge & Baird, Consulting Engineers.
New York City.

Slide Rule for Number of Rivets

SIR: In looking through some old papers recently I came across a slide rule which I designed in 1907 which gives with very little effort the number of rivets required in riveted connections.

Believing that this may be of interest to some of your numerous readers I am inclosing herewith two of the rules made up in usable form, and two sets of instructions which I prepared for their use. If any of your readers are interested in this I will be glad to give them rules free of charge from the small lot that I have on hand.

W. WATTERS PAGON,
Baltimore. Consulting Engineer.

Shallow Brick Economical

King County, Washington, has recently laid 3 miles of a monolithic brick pavement 20 ft. wide on which brick 2¾ in. deep was used. These brick, laid on the cut side, cost $21.75 per 1000 and require only 36 to the square yard. The standard pavers, laying 41 to the square yard, cost in King County $28.75 per 1000. The estimated saving is about $5,000 per mile. The brick used are of the "vertical-fiber" type.

HINTS FOR THE CONTRACTOR

Details Which Save Time and Labor on Construction Work

Other articles in this issue of interest to contractors and construction engineers are indexed in the Table of Contents

Contributions to this section are solicited, and if found available will be paid for. They must be SHORT, *and should be accompanied, if possible, by photographs or sketches.*

Heavy Smithing Job Done in Open on Bent Crusher Spindle

By H. S. CARPENTER
Cobleskill, N. Y.

BY PLACING it horizontally on two rails so that it could be rolled over at the right moment, and building a brick furnace around it, the writer recently straightened in the open the spindle of a No. 6 McCully gyratory crusher which had been bent just below the bell until the bottom bearing was 2⅝ in. off center. As may be seen from the photograph the spindle and bell were supported so that they could be rolled over on two light rails blocked up from the ground.

Around them there was built a furnace of firebrick and fireclay in the bottom of which was an air blast supplied through a hose from the compressor plant. The spindle was placed with the concave side of the bend down over the hottest part of the furnace. It was heated until it scaled a little more than half way around, when the furnace was quickly torn down and the spindle rolled over until the concave side was on top.

Four men working in relays, two at a time, then drove down on the top of the spindle with 14-lb. sledges while water was played on the under side of the bend with a hose. The wetting caused that side to contract, and straighten the bend. The sledging compressed the metal on the under side of the spindle so that it did not bend up again when cooling. The job was a complete success in straightening the spindle, which is now in service in the crusher, and up to the present time has shown no signs of weakness.

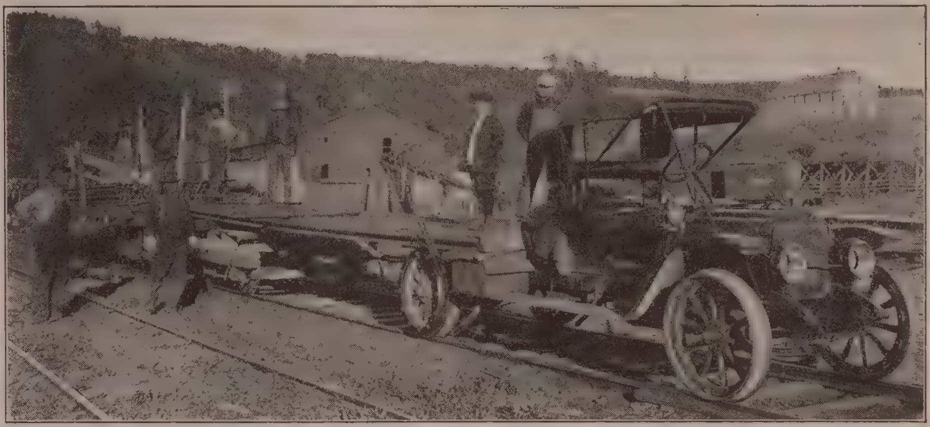
SPINDLE WAS HEATED ON INSIDE OF BEND, THEN ROLLED OVER AND STRAIGHTENED

Motor Truck with Flanged Wheels Draws Flat-Car Trailer

MOTOR TRUCKS equipped with steel flanged wheels for operating on rails have made it possible and practical for railroads and construction companies to salvage rails on abandoned spur lines and in construction camps where heretofore the cost of reclaiming the rails by other methods was exceedingly high. A recent test on the Chicago, Burlington & Quincy Railroad bespeaks the success of the trucks.

The Burlington decided to salvage the rails on the abandoned McLaughlin lumber and tie road connecting the station at Nahant, in the Black Hills of Montana, with the forests 35 miles to the west. The contract for the job was awarded to the Black Hills Transfer Company. A locomotive could not be used to haul the rails, because the forest reserve laws require oil burners, and only wood burners were available. Furthermore, the track had not been kept in repair, and the cost of putting it in shape to permit the use of a heavy locomotive would have been prohibitive.

The contractors finally decided to try out a motor truck. An order was placed with the White Company in Cleveland for a standard 1½-ton truck, which was shipped to the Burlington railroad shops at Havelock, Neb. There it was equipped with a set of steel wheels with flanges for operating on rails, reshipped to Nahant, Mont., and put to work.



MOTOR TRUCK ON TRACK HAULS 12 TONS OF RAILS WITH FLAT CAR AS TRAILER

During the first month the truck was in service it covered about 3300 miles, averaging 108 miles a day. By the use of a flat car as a trailer, 12 tons of rails were hauled into Nahant each trip. The truck made two round trips a day, climbing several grades as steep as 7 per cent on second and third gear and registering an economy record of better than 10 miles to a gallon of gasoline. After depositing its load at Nahant the truck made the 27-mile trip to the forests on fourth speed.

Cantilever Forms Save Tie Rods on Thick Lock Walls

THE cantilever type of wall forms developed at Panama has been cleverly adapted in the construction of walls up to 40 ft. and more in thickness for Lock 2 on the Welland Ship Canal. In the use of these forms, anchor bolts 18 in. long are embedded as each lift of concrete is placed. These bolts, on a line near the top of the lift, project through the concrete after the forms have been removed. Posts made of two 4 x 10-in. timbers laced together, and of sufficient length to reach from the top of the next lift to a point several feet below the line of anchor bolts, are then stood up and clamped against the concrete by these bolts. These posts, acting as cantilevers above the bolts, support the next lift of forms during concreting. On the work referred to, described at length on page 490 of this issue, these forms are used not only for the vertical face, but for the back face of the lock walls, which is offset in steps. This is accomplished by bracing the form slabs to the uprights with short horizontal posts, as is plainly shown in the accompanying photograph. For work where large

CANTILEVER WALL FORMS USED ON CANAL

batches of concrete are dumped from a bucket, as in this case, and where very long tie rods would be readily bent or broken, these forms are a great advantage.

Work on the Welland Ship Canal is under the direction of J. L. Weller, engineer in charge for the Department of Railways and Canals. Baldry, Yerburgh & Hutchinson are contractors for Section 2, on which the forms described are in use.

Deck Trusses Changed for 100-Foot Girders Between Trains

By A. HALL
Akron, Ohio

TWO deck girders, each weighing 80 tons and forming a span 103 ft. long, were recently set by the writer in 30 minutes each by shifting the track to one side, cutting off the caps of pony bents which supported it, lowering the girder to place and shifting the track back on top of it. The girders were set between trains in 30-minute intervals, arranged with the dispatcher, and the entire work was carried out without delaying a single train.

Falsework, of which ten bents were required, was first driven and capped below the bottom chord of the old deck truss to support it. Inside the truss, on top of this falsework, were erected pony bents which were capped to support the track itself. All the interior steel of the old bridge was then removed, leaving the two trusses standing alone.

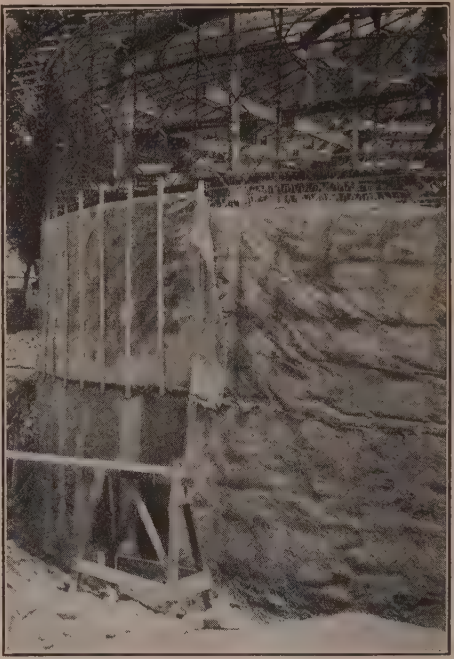
The only hoisting equipment available to set the new girders was a 15-ton Browning locomotive crane and a Lidgerwood hoist used in driving the falsework. Each girder had to be set just outside the rail under the ends of the ties, and the pony bents could not, of course, be made narrow enough to permit this. A heavy A-frame was set up at one end of the bridge and an eight-part wire rope fall, led to the hoist, was used to handle one end of the girders, while the other end was handled by the crane on a high boom. The girders were brought out on the span, on cars, picked up with this equipment and lowered on the pony bents outside the track directly over the outer line of posts. The caps of these bents on one side of the track were then sawed nearly through 3 ft. from the end between the girder and the track. In the 30-minute interval arranged for with the dispatcher this girder was again hooked by the falls and the crane, the caps were cut entirely through and the short ends under the girder turned around lengthways on the dowel pins holding them to the posts of the pony bents. Meanwhile the ties had been slid as far over to one side as possible, and jacks and blocking had been set on the pony bents under the track to raise it slightly until the girder could be placed. Turning the ends of the caps left a slot in which the girder could be lowered and swung over to place. As soon as it was set the ties were slipped back over it and the track lowered.

To set the girder on the other side, the ties were slid the other way over the first girder and that side of the track chained down to the truss on that side. We merely blocked or jacked this side, a little high, of course, to elevate the track enough for clearance of the entering girder. The remaining part of the pony bents which had supported the other side of the track up to this time were then knocked down on to the lower falsework after the second girder had been raised clear, and this girder was then lowered and set as the first one had been. The track was then unchained and replaced, and the bracing put in.

The entire work took some time, as the road was very busy and there was a severe penalty for delaying any trains. The crane had to be taken into a siding at least twenty-five times during the work. The bridge described is on the Louisville & Nashville Railroad in Kentucky.

Cement Gun Makes Monolithic Reservoir Without Forms

BY draping canvas over the framework of reinforcing, a concrete reservoir at Elmhurst, Ill., has been built with a cement gun without forms. When the first layer shot from the inside against the canvas secured to the outside has set, further building up of the layers by the gun is easily accomplished. The first reservoir of this type was constructed in 1912 at Cary, Ill., but experience since then has led to a number of improvements. Successful results depend on the skill of the operator, for in the hands of inexperienced men defects are likely to occur which are not discovered until the reservoir is put in service.



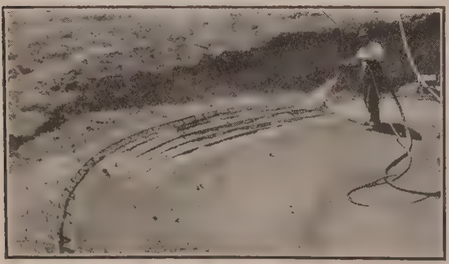
CANVAS MAKES BACKING FOR FIRST COAT

A light structural-steel frame of angles and bars is erected with the required amount of spiraled reinforcing bars with hooked ends securely fastened to the frame. Over this reinforcement is placed a heavy triangular wire mesh, which serves as additional reinforcement, but chiefly to hold the concrete in place while setting. When the entire frame, reinforcing and wire mesh have been erected, heavy canvas ducking is stretched over the outside of the frame and upon this, from the interior, is applied with the cement gun about 1½ to 2 in. of 1 part cement to 3 parts clean coarse sand and gravel. When this coating has set a short time the canvas is removed and additional layers of dense concrete are applied from both the exterior and interior, building up the walls to the desired thickness. The root or cover is constructed in the same manner. On reservoirs about 20 x 30-ft. walls are made 6 in. thick and the roof 3 in.

One of the striking features of this method is the variety of cornices that can be built by an expert nozzle operator. These are struck off to true lines by means of a "sweep" and may be left either rough cast or finished to a troweled surface.

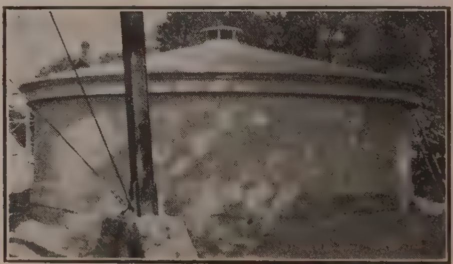
It is asserted that the costs are less than when using forms and that the dense concrete makes a waterproof reservoir.

The work at Elmhurst was carried out by the Dewey Cement Gun Company and the method has been developed by the company and Harry L. Emerson, consulting engineer, Chicago.



EVEN THE FOUNDATION IS SHOT IN

BUILDING UP FIRST COAT FOR INSIDE



PLEASING CORNICES MADE WITH SWEEPS

NEWS OF THE WEEK

Passing Events in the Civil Engineering and Contracting Fields

Tumult Reigns as Municipal Improvements Convention Adopts Paving Specifications

Scenes of Wild Confusion Mark Defeat of Proposals to Accept Alternate Asphalt Specification and to Reject Bitulithic as Standard

Into the convention of the American Society of Municipal Improvements at Newark, N. J., last week, twin bombshells were thrown Thursday night. No detonation occurred, for the sputtering fuses were smothered in a blanket of parliamentary confusion. Nevertheless, the menace of the high explosives, in the form of an alternate asphalt specification and a rejection of Bitulithic—patented—as one of the society's "standards" created a near-panic, and sent members scurrying from convention hall to hotel lobby for reinforcements to resist the assault upon the positions won at Dayton and elsewhere in the campaigning of former years. The scene was one of wild confusion. Motions and amendments to motions, calls for adjournment, shouts of "You're out of order!" "Question!" and "Sit down!" and attempts to determine the will of the meeting, first, by a standing vote, second, by herding members into groups at opposite ends of the hall, and finally by roll call, lent to the meeting a color which is commonly associated with a political broil, rather than with the deliberations which would be expected of an engineering body in passing upon the merits of a technical question.

Action on Asphalt and Bitulithic

From the tangled mass of débris which represented the evening's proceedings it is not easy to construct a coherent statement of what really happened. Certain it is that the alternate asphalt specification was defeated, and that the proposal to reject Bitulithic pavement as one of the society's standards was "laid on the table." Excitement ran high, and into the proceedings was interjected every trick of parliamentary procedure which could becloud the issues under discussion. Things reached such a stage that very few of the members, apparently, seemed to know what they were voting on. As an instance of this, the chairman of the general committee on paving specifications, when his name was called, voted in favor of a resolution which he had been vigorously opposing for an hour or more, and, when a roar of laughter ensued, changed his vote.

The tranquil opening of the session on paving specifications on the night of Oct. 12 gave no hint of the storm which was soon to break. According to the program, the presentation of the committee reports on specifications was to take place after seven general papers on paving subjects had been offered. If this schedule had been followed the convention would have been ready to consider its paving specifications at about midnight. Nevertheless, President Macallum called for the first of these seven general papers, but E. A. Fisher interposed with a resolution, which was carried, calling for the omission of the general papers and the immediate consideration of the paving specification reports.

Alternate Specification Proposed

Prof. A. H. Blanchard reported for the subcommittee on broken stone and gravel roads. To his recommendations there appeared to be no objection. After the call for the report of the committee on asphalt by Francis P. Smith, chairman, there was a noticeable awakening of interest throughout the audience. Mr. Smith explained certain changes which the committee had made in the existing open specifications, the chief one involving a modification in the grading of sand. It was then that the sensation of the evening was sprung when Abraham Swan, engineering department, Trenton, N. J., advocated that the society adopt alternate specifications for asphalt—specifications which would differentiate the so-called refined and natural asphalts. These alternate specifications were prepared by Walter H. Flood. Mr. Swan contended that Trenton's experience with the society's open specifications had been unfortunate enough to justify the change he proposed. In this claim he was supported by Commissioner F. G. Simmons of Milwaukee, who said, with some heat: "We want a distinction between lake and oil asphalts." Then the full fury of a verbal tempest was released. Members sprang from their seats to hold whispered conferences with their fellows. The creation of an alternate asphalt specification was moved as an amendment to the subcommittee's report, which favored the existing blanket specification. With members darting to and fro in all parts of the room and standing in the aisles, a standing vote was called for under conditions which made an accurate count wellnigh impossible, and the alternate asphalt specification amendment was lost, according to the secretary's count, by the close margin of 46 to 44. Appeals for a recount were unheeded by President Macallum, the presiding officer.

Bituminous Discussion Reopened

This action closed the discussion on asphalt for the time being and Linn White, of Chicago, chairman, presented a report of the committee on bituminous paving, which was passed unanimously. It then developed, after the passage of the specification, that Bitulithic pavement, which had been sanctioned as a standard at the Dayton convention last year, was excluded from the specifications presented by this year's committee. Again the convention hall was in an uproar. After much confusion as to the correct parliamentary procedure to bring the matter again before the meeting, the question was again opened for discussion. It was claimed that Mr. White's report had not been fully understood by the general committee, which had proceeded on the assumption that Bitulithic pavement was retained in the newer specification. Motions and counter-motions then began to fly thick and fast. On several occasions, when the call for a vote was made, President Macallum was unable to state clearly upon what matter the meeting was voting. A motion to lay the whole matter on the table was lost by a vote of about 50 to 59, and then with nothing decided, a motion to adjourn was made by E. A. Kingsley and later withdrawn.

At this stage of the proceedings the scheme of counting, or attempting to count, standing votes was abandoned in favor of herding members for or against any motion to opposite ends of the convention hall, a move which, if possible, added to the general disorder of the meeting. The upshot of the whole matter was that in spite of protests by Mr. White and W. H. Connell, of Philadelphia, the Bitulithic specification was retained as a standard, its

(*Continued on page* 514)

Waterworks Technical Staff Gets Tactful Job

Illinois and Iowa Sections Discuss Insanitary Drinking Fountains and Hear a Lucid Statement About Commission Rule

That waterworks officials are now turning to the members of their technical staffs to handle complaints was brought out clearly in one of the papers presented to the Iowa section of the American Waterworks Association at the Davenport meeting Oct. 10. Startlingly insanitary conditions of modern so-called sanitary drinking fountains and a lucid statement of the present status of commission control of waterworks were features of the two-day meeting of the Iowa section, with which the Illinois section joined on the second day.

About 100 persons registered from the two states. The Iowa men elected the following officers: C. R. Henderson, chairman; S. L. Etnyre, vice-chairman; F. D. Lawlor and Philip Carlin, directors. The annual meeting of the Illinois section will be held in March.

Technical Staff Gets More Work

Earl T. Kirkpatrick, chemist and bacteriologist, Des Moines Water Company, told of his experience in handling complaints which are filed in the laboratory and plotted on a map to show graphically their distribution, as well as to aid in routing the order of the calls. The ground water in his city may, at dead ends, show iron color from crenothrix. The chemist explains to the consumers that the water is not bad hygienically. If it is colored enough to affect laundry work, a nearby hydrant is opened to flush out the main; otherwise nothing is done. For complaints of sediment a Whipple sediment test is made. Samples are always taken and the case followed until the consumer is convinced of the purity of the water. The results of less than a year's trial warrant a continuance of the practice. Confidence is engendered and there are fewer chronic "kicks" since the company has encouraged people to complain.

In discussion, Mr. Etnyre said his experience with complaints from new mains led him to believe that an oil leached out of the yarn. Paul Hansen spoke of a successful newspaper publicity explanation of the presence of a larval worm in the water at Champaign and Urbana. W. W. DeBerard, Western editor of the Engineering Record, stated that the Denver Union Water Company had recently turned over all complaints of the quality of the water to the technical staff with success. The consumers seemed more easily assured when confronted by a technical man, but the latter had to use much tact. One of the things always done was to drink a glass of the water in the presence of the householder.

Dry Lime Feeder

J. B. Thornell, chemist, Council Bluffs waterworks, in his paper on the treatment of the Missouri River water, described a dry lime feeder. A large iron hopper is filled with dry hydrated lime. In the bottom is a worm which pushes the lime into a smaller, funnel-shaped hopper below. A stream of water flows into the lower funnel, dissolving the lime and carrying it out through a 2-in. pipe to a weir between the first and second settling basins. A small electric motor drives the feeding device and is also attached to a small centrifugal pump which draws the water for dissolving the lime from one of the settling basins. By an arrangement of pulleys and gears the speed of the worm may be regulated as desired. About 30 gal. of water is used for each pound of lime. The large volume of water used is one of the main factors in the success of the treatment, because it completely dissolves the lime, thereby preventing clogging of pipes and bringing about thorough mixing of the lime solution with the raw water before it receives the charge of alum solution.

Prof. J. H. Dunlap, Iowa City, has been examining sanitary drinking fountains and observing drinkers. One of thirty-nine fountains, he finds, is so arranged as to prevent people from getting their lips upon the surfaces. Bacteria, like a whirling ball in a garden fountain, dance up and down in the rising jet for long periods. Only a fountain that is protected and one in which the jet spurts clear of the supply opening will meet the requirements. The section appointed a committee to make further studies.

Leonard Metcalf, president of the national association, gave the address on commission control of properties. His paper, which is too long and the subject too intricate to abstract, is a most logical and convincing statement of the present status of affairs. Good service to the consumer and fair play to the waterworks was the burden of his talk.

A. E. Miller, a contractor of Des Moines, told of his experiences in France and Russia behind the lines with a modern trenching machine. Even though trenching machines represent the latest type of development for ordinary work they are not ideal for war purposes. They should be more largely experimented with, in Mr. Miller's opinion, mainly because the ideal trench is two series of short ditches connected by trenches at right angles to prevent an effective enfilading fire. Zigzag trenches 50 ft. from point to point and curved ones could be built and were considered satisfactory for the reserve line. The machines were found to be most suitable for preparing communication trenches. Twenty-two of them were tuned up with crews by Mr. Miller at Moscow for use back of the Russian front. In France the terrain was too congested to make the machines feasible.

WATERWORKS MEN VISIT DAVENPORT PLANT—T. N. HOOPER, VICE-PRESIDENT, ALTHOUGH 83 YEARS OLD, INSISTED ON ACTING AS GUIDE FOR HIS GUESTS

Must Protect Banks Above and Below Weir at Hanlon Heading

Finding that the temporary rock weir and pile trestle being constructed across the Colorado River by the Imperial Irrigation District below the intake of its canal at Hanlon Heading is interrupting the regular flow of the river and thereby causing erosion of the Arizona shore, Major G. B. Pillsbury, Corps of Engineers, U. S. A., Los Angeles, has notified the district that steps must be taken immediately to protect the banks of the river above and below the weir. A spur track must be built from the railroad on the Yuma Irrigation District's levee and rock hauled and dumped along the banks for a distance of 800 ft. above and below the weir.

The weir was being constructed as an emergency measure to raise the water level at the intake and was to be removed Jan. 1, 1917. Efforts were made to check the scour by depositing rock and brush by hand. Major Pillsbury held that this would not be effective during a freshet.

Tumult Reigns as Municipal Improvements Convention Adopts Paving Specifications

(*Continued from page* 513)

chief proponents being Morris Sherrerd of Newark and E. A. Kingsley of San Antonio.

Engineering Record Sustained

In view of the Engineering Record's arraignment, in several recent editorials, of the procedure of the American Society of Municipal Improvements in making paving specifications, two significant admissions were made during the excited discussion. Mr. Kingsley said: "With these things being brought in at the last minute, no wonder we are subject to so much criticism from the engineering press." A particularly violent outbreak during the controversy moved Mr. Sherrerd to remark: "We have been severely criticised by the engineering papers for just this kind of procedure. We cannot afford to do this sort of thing."

When everybody was ready for the next order of business an interesting development occurred. Col. J. W. Howard called attention to the fact that the convention had neglected to pass the open specification recommended by its subcommittee, headed by Francis P. Smith. Then someone voted to reopen the entire discussion on the alternate asphalt specification, and by means of a roll call vote, consuming almost an hour's time, the alternate specification was defeated by a vote of 33 to 59. It was then about midnight and the meeting adjourned till the following morning.

At the morning session a wood-block specification, allowing the use of water-gas tar as well as coal-tar products, was passed.

The wild scenes of the night before had apparently had a sobering influence on the membership, for by a resolution of Prof. A. H. Blanchard authority was granted for the appointment of a committee to investigate and report upon changes in the constitution.

The brief session on the afternoon of Wednesday, Oct. 11, was devoted entirely to sewage treatment. A number of excellent papers were scheduled, among the authors being T. Chalkley Hatton, Harrison P. Eddy, George T. Hammond, George W. Fuller and others. As the room had to be vacated early for banquet preparations, the program was not finished and no opportunity for discussion was offered, although in the audience there were sanitary engineering experts of national prominence who had made the trip to Newark with this object specifically in mind. The discussion, however, was postponed till "promptly at 9 o'clock to-morrow morning." With a mere handful present at this later occasion the subject was speedily disposed of.

Next year the convention of the society will be held at New Orleans. The following officers were elected: President, N. S. Sprague, of Pittsburgh; first vice-president, E. R. Conant, Savannah, Ga.; second vice-president, G. H. Norton, of Buffalo; third vice-president, R. Keith Compton, of Baltimore; secretary, C. C. Brown, of Chicago; treasurer, F. J. Cellarius, of Dayton.

American Road Builders Convene November 3 in New York City

The annual meeting of the American Road Builders' Association will be opened at 2 p.m. Nov. 3, at the Automobile Club of America, New York City. Aside from a meeting of the board of directors and reports of officers and committees, the principal interest will center in the election of officers for the year 1916-1917. While this is now being conducted by means of a mail ballot, the polls will not close until 4 p.m. of the day of the meeting. The annual dinner will be held in the grill room of the Automobile Club, at which the result of the election will be announced.

Lake Washington Canal Will Be Opened About July 1, 1917

The Lake Washington Canal will be opened for traffic not later than July 1, 1917, if the Seattle bridge situation does not interfere with the remainder of the dredging operations. According to G. F. Nicholson, acting chief engineer of the Seattle Port Commission, the Fifteenth Avenue bridge at Salmon Bay is 85 per cent finished and will be completed by next April. The Fremont bridge is 90 per cent completed and is expected to be ready by Feb. 1, 1917. The Latona bridge across Lake Union is being delayed by reason of certain technical investigations concerning the foundations. However, if the work is carried on as per contract the Latona bridge would not be finished before Jan. 1, 1918, and would therefore seriously affect the date on which navigation may be inaugurated between Lake Union and Lake Washington.

The Lake Washington Canal Association met at the Seattle Chamber of Commerce Oct. 2 to confer with representatives of the Chamber of Commerce, the Municipal League, the Commercial Club and the Port Commission as to what action was advisable. A committee was appointed to confer with A. H. Dimock, city engineer, who is working on two plans to relieve the Latona bridge situation by providing drawspans in the present trestle. The canal association will further discuss the problem with Col. J. B. Cavanaugh, who has charge of the work.

Defense Board Named by President

President Wilson announced late last week the appointment of the members of the advisory commission to be associated with the Council of National Defense recently created by Congress. The appointees are: Daniel Willard, president of the Baltimore & Ohio Railroad; Samuel Gompers, president of the American Federation of Labor; Dr. Franklin H. Martin, of Chicago; Howard E. Coffin, of the Hudson Motor Car Company; Bernard Baruch, of New York City; Dr. Hollis Godfrey, president of Drexel Institute and consulting engineer, Philadelphia, and Julius Rosenwald, of Chicago.

The council will work to co-ordinate all forms of transportation and to develop means of meeting the military, industrial and commercial needs of the nation. It will also extend the industrial mobilization work of the committee on industrial preparedness of the Naval Consulting Board.

Inaugurate Highway and Engineering Administration Courses

The Bureau of Municipal Research, New York City, has added courses in municipal highway engineering and engineering administration to those offered by the training school for public service. Ernest P. Goodrich, consulting engineer to the Borough of Manhattan and to the board of estimate and apportionment of New York City, will have charge of instruction in engineering administration. Arthur H. Blanchard, professor of highway engineering, Columbia University, will instruct in municipal highway practice.

The Engineer

By DR. FRANK CRANE

The man of the future will be the engineer.

He is the man who can *do* things; and is better than the man who *owns* things.

The millionaire is a temporary, passing, makeshift product of civilization. He is merely holding things together until the people get sense enough to do their own owning.

Some day little boys will read that the world once had millionaires and huge private wealth units, just as they will one day read and wonder that men once had kings.

But the official who will forever be indispensable is the engineer.

The time will come when the President of the United States will be chosen as the man who has the greatest talent and skill in organizing public works. There will be no more politics in his selection than there is now in choosing the master mechanic of a railway or factory.

When a nation goes to war nowadays, that is, when it becomes necessary to exert its supreme collective strength, nobody dreams of electing the most popular politician or the cleverest speechmaker to lead the armies. It is the man who can get the last ounce of efficiency out of men and metal that is wanted.

Some day the nation will realize that it is continually in a crisis, and that in peace as in war we need the highest order of efficiency and organization.

We need the engineer to arrange the transportation of people and goods from place to place, without waste, without competition, without graft, looking only to the public good.

We need the engineer to get meat, bread, and milk from farm to citizen, without the present inefficient tangle of trusts and middlemen working at cross purposes.

We need the engineer to turn the public enterprise toward building good roads and bridges, instead of enriching a few shrewd manipulators.

We need the engineer to manage a city as economically and smoothly as if it were a manufacturing plant.

We need the engineer to organize the farmers so that all can work together for each, and their products be marketed without being preyed upon at every step of the way from farm to household.

Wealth can be taken away from us. But the power to *do* things cannot be taken away.

The millionaires could go and not be missed. The engineers we cannot spare.

"What availeth all thy wealth?" said the ancient philosopher. "He that hath better iron than thou will come and take away all thy gold."

Says H. L. Gantt:

"The man who knows what to do and how to do it is pre-eminently the engineer. The new world which is being ushered in by the great struggle now taking place is one in which the engineer is destined to be the supreme power, for it is becoming clear that, in future, the man who *owns things* will not be as important a factor in the world as the man *who can do things*."

Engineering Society Activities

The San Francisco Association of Members of the American Society of Civil Engineers held a meeting last Tuesday, at which G. A. Elliott described the Calaveras hydraulic-fill earth dam. An inspection trip will be made to-day to the dam as guests of the Spring Valley Water Company.

The American Society of Civil Engineers will meet Nov. 1 to hear a paper by F. H. Peters, commissioner and chief engineer of irrigation of Canada, outlining a complete method for the classification of irrigable lands.

The Associated Engineering Societies of St. Louis conducted an inspection trip to the Chouteau Avenue viaduct last Saturday. The 80 x 1560-ft. structure of flat-slab construction eliminates a grade crossing on the tracks of the Missouri Pacific Railway. The bridge embraces a model subway and cost $200,000, exclusive of land and damages.

The Western Society of Engineers will celebrate ladies' night Oct. 30 at Chicago. Lantern slides showing mountain climbing will be thrown on the screen. D. W. Roper will do the talking. The next business meeting is scheduled for Nov. 6, at which A. S. Zinn, consulting engineer for the Republic of Panama, has prepared a paper on narrow-gage railway construction in Panama.

The Engineers' Club of Trenton, N. J., will meet Oct. 26 to hear Joseph A. Steinmetz, president of the Aero Club of Pennsylvania, discuss aerial warfare and terrestrial and submarine devices.

The Detroit Engineering Society will meet Friday evening, Nov. 3. Bela Nagy, chief engineer of the hydrated-lime bureau of the National Lime Manufacturers' Association, will discuss hydrated lime and its use in concrete and mortars.

What Engineers and Contractors Are Doing

Erwin Harsch has resigned as aid in the U. S. Coast and Geodetic Survey corps to become instructor in civil engineering at the University of Tennessee. Since graduation from the civil engineering department of George Washington University in 1915 he has been employed by the Survey on various kinds of hydrographic work.

Leonard Metcalf, consulting engineer, of Boston, has completed the work of directing the preparation of the inventory and the submission of the engineering evidence bearing upon the value of the property of the Spring Valley Water Company, in the fair suit (covering the period 1908-1915) before the federal court, which was intrusted to him by the company nearly three years ago. The hearings consumed 153 days, exclusive of the argument, which was begun Aug. 10 and completed Sept. 4, 1916. The evidence is now before the standing master in chancery of the federal court of the northern district of California for decision.

C. A. Fitzmaurice has resigned from the employ of the United Fireproofing Company to become superintendent for Lewis A. Miller, building contractor, of Meriden, Conn. He is at present directing the erection of a six-story concrete building in that city.

W. C. Hirn has secured a leave of absence as borough engineer of St. Marys, Pa., in order that he may take up special work in sanitary and municipal engineering at the University of Michigan.

H. W. Hartmann, formerly instrumentman and inspector for K. C. Gaynor, consulting engineer, of Sioux City, Iowa, is now junior engineer in the Illinois highway department with office at Peoria. Mr. Hartmann has been associated with K. C. Gaynor since graduation from the University of Iowa.

Elmer G. Fuller, for the past two years junior civil engineer in the Chicago office of the Division of Valuation of the Interstate Commerce Commission, has resigned. He is now a member of the sales force of the General Fireproofing Company, with headquarters at Youngstown, Ohio. Mr. Fuller was graduated from the University of Michigan in 1911.

J. L. Parsons, formerly county engineer of Humboldt County, Iowa, succeeds G. P. Smith as county engineer at Fort Dodge. Mr. Parsons received his education in civil engineering at Cornell College and from the American School of Correspondence. After spending about a year with different railroads, he was appointed assistant city engineer of Pierre, S. D. Since July, 1908, Mr. Parsons has engaged in private practice at Humboldt, Iowa, paying particular attention to county drainage work.

G. P. Smith has resigned as county engineer at Fort Dodge, Iowa, to take the position of drainage engineer of Redwood County, Minnesota, with headquarters at Redwood Falls.

James G. Wray has resigned as chief engineer of the central group of the Bell telephone companies to become associated with Hagenah & Erickson, public utility engineers, of Chicago.

W. W. Van Every has resigned as city engineer of Sault Ste. Marie, Ontario, to become general manager of the city water and light department.

Albert Jewell, formerly operating chemist of the filtration plant at Toledo, Ohio, is now assistant sanitary engineer of the Kansas board of health. He was graduated from the University of Michigan this year.

John H. Bringhurst, a graduate of the University of Michigan, class of 1910, has resigned as instructor in civil engineering at his alma mater to join the engineering department of Johns Hopkins University.

O. M. McNeil, who during the last five years has been employed by the American Bridge Company, the Dominion Bridge Company and the A. J. Smith Construction Company, has been appointed instructor in civil engineering at the University of Michigan. Mr. McNeil was graduated from the civil engineering department of the University of Colorado in 1911.

Perry A. Fellows recently resigned as general superintendent for the Winnsboro-Granite Corporation to become instructor in civil engineering at the University of Michigan. Since graduation from that institution in 1906 he was engaged on railroad work until his association with the Winnsboro corporation.

Earl Denny, a 1914 graduate of the University of Missouri, will become county surveyor and highway engineer, with office at Liberty, Mo., on Jan. 1, 1917.

Prof. F. H. Newell, of the University of Illinois, and formerly director of the U. S. Reclamation Service, will address the Chicago Association of Commerce Oct. 25 on "Drainage in Illinois." Only about once a year are engineers invited to address this noonday meeting of 400 to 500 business men.

George Allan Kyle, consulting engineer, of Portland, Ore., and specialist in railroad engineering, has been chosen by the American International Corporation as the engineer to have charge of the 1100 miles of railroad to be built in China by the Siems-Carey Railway & Canal Company. As noted in the Oct. 7 issue, the work is being financed by the American International Corporation, the officers of which have selected Mr. Kyle to direct the work, the estimated cost of which runs into the millions. The recent approval by the Chinese Government of Mr. Kyle's appointment concludes the preliminary arrangements and the engineer expects to sail early in November. Mr. Kyle was born in Tobasco, Ohio, in 1857. A business course and a short period of instruction in civil engineering preceded his first engineering job in 1876 as rodman. The following six years were spent on railroad construction in Iowa, the last one as locating engineer for the South Dubuque & North Western Railway. The next year found Mr. Kyle division engineer in charge of the location and construction of 30 miles of railroad for the Cincinnati & Eastern Railway. He returned to Iowa in 1884 and until 1886 directed location and construction in that state and Illinois for the Chicago Great Western Railroad. For the next few years Mr. Kyle was engaged on railway location in the Dakotas for private companies and on the revision of the main line of the Union Pacific Railway in Wyoming. He spent the next four years with the Northern Pacific Railway in the Northwest, a year in the employ of the Baltimore & Ohio South Western and in 1895 became associated with the Summer & Jack Gold Mining Company, Limited. His duties with that organization took Mr. Kyle to South Africa, where he had charge of surface improvements and the development of deep-level mines. Upon his return to the United States in 1899 he again entered the employ of the Northern Pacific in charge of location and construction. Railway construction in Canada drew his attention in 1902 and for two years he was associated with the Grand Trunk Pacific Railway, with headquarters at Winnipeg. During 1904 he did special work for the Northern Pacific, and for the following two years was engineer of surveys and consulting engineer on construction for the Alaska Central Railway. He returned to the States in 1907 to become assistant chief engineer of the Chicago, Milwaukee & St. Paul Railway on the Pacific Coast extension, and two years later was appointed chief engineer of the Oregon Trunk Railway. When he resigned in 1910 to engage in private practice he was vice-president and general manager of the latter road. Mr. Kyle is now in New York City preparing for his new work in China.

American Engineer Employed by Chinese Government to Direct New Railroad Construction

Photo by Paul Thompson

GEORGE A. KYLE

Samuel Morreell, Jr., Oscar F. Gayton, Frank C. Van Etten and Robert F. Gayton announce that they have become associated under the firm name of Utilities Engineering Company, with offices in the Webster Building, Chicago. They will continue their individual practices of engineering as applied to the preparation of plans, specifications, reports and valuations of water and electric utilities, sanitary and civic improvements.

Nathan C. Johnson, consulting concrete engineer, of New York City, who reported on the causes and the extent of the failure at the new Cleveland water filtration plant, has been further retained to make designs for the reconstruction.

Walter W. Weir, senior drainage engineer, office of public roads and engineering, U. S. Department of Agriculture, was recently at Reno, Nev., where the possibilities of draining the Truckee meadows, which cover an area of approximately 10,000 acres, was considered. Mr. Weir made the investigation in conjunction with F. L. Bixby, government irrigation engineer, and J. G. Scrugham, of the University of Nevada.

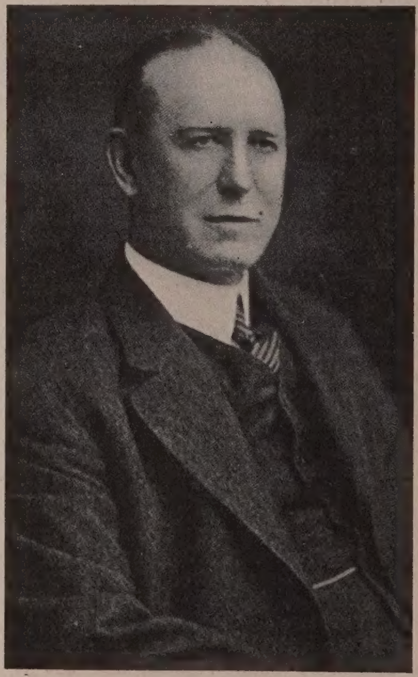
Obituary Notes

Lawrence M. Thacher, for the last ten years in the engineering department of the Georgia Railway & Power Company, died recently at Atlanta, Ga. Mr. Thacher was a native of Yarmouth, Mass. He was graduated from the Massachusetts Institute of Technology in 1886. For fourteen years he had been engaged in engineering in the South—for a time at Little Rock and then at Birmingham—before going to Atlanta. He was president of the Atlanta section of the Engineering Association of the South.

Ralph Tolles Norton, railroad contractor, died in New York City, Oct. 9. Mr. Norton had been engaged on numerous large construction contracts, having been associated with the Carter Construction Company, the F. M. Ferguson Contracting Company and the Degnon Contracting Company. At the time of his death he was a member of the firm of Norton, Head & Denneen, New York City, which recently completed the contract for the construction of the Mill Creek joint district sewer in St. Louis, involving an expenditure of nearly $3,500,000.

Robert Swan, director of the department of public works of Pittsburgh, died last Saturday at his home in that city at the age of 57. Mr. Swan was born in 1859 in the old city of Allegheny. After graduation in 1877 from the Western University of Pennsylvania, now the University of Pittsburgh, he was for several years associated with his father, John Swan, a contractor, who built a large part of the Baltimore & Ohio Railroad through Western Pennsylvania. That was followed by his appointment as city engineer of Allegheny, and later as a member of the engineer corps of the Baltimore & Ohio Railroad. He had risen to the position of assistant engineer of the Pittsburgh division at the time of his resignation to become associated with the T. A. Gillespie Company, of New York and Pittsburgh. For about seventeen years Mr. Swan was in that company's employ, during which time he participated in the carrying of the Catskill Aqueduct under the Hudson River at West Point, the construction of the filtration plant at Aspinwall and work on the New York State canals. In January, 1914, he resigned as vice-president and general manager of the T. A. Gillespie Company to become director of the department of public works of Pittsburgh.

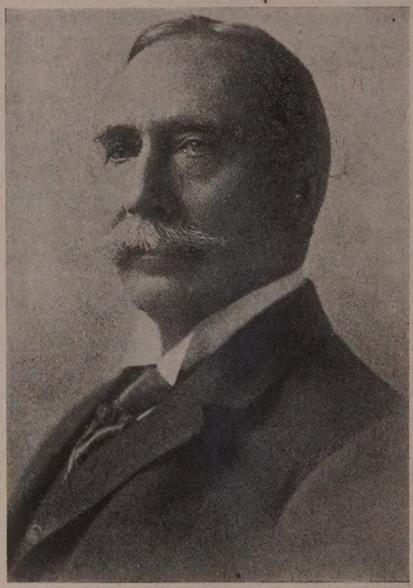
Director of Public Works of Pittsburgh Died Last Saturday



ROBERT SWAN

Virgil Gay Bogue, consulting engineer, of New York City, died Oct. 14 on a steamer as he was returning from Mexico. Mr. Bogue was born July 20, 1846, at Norfolk, Va. After being educated at the school of Gen. William H. Russell of New Haven, Conn., he entered Rensselaer Polytechnic Institute, from which he was graduated in 1868. A year with the engineering corps of Prospect Park, Brooklyn, N. Y., was followed by a trip to South America. For several years he was engaged on railway construction in Peru, later being made manager of the Trujillo Railways. When active hostilities broke out between Peru and Chile Mr. Bogue returned to the United States. From 1880 to 1886 he directed surveys and construction for the Northern Pacific Railroad across Idaho and Washington to the Pacific Coast. The following five years he spent with the Union Pacific system as its chief engineer. Since 1891 Mr. Bogue maintained offices in New York City. He was a member of the commission appointed by President Harrison to investigate methods for improving the Columbia River. As consulting engineer to the Governor of New Zealand for three years he directed the selection of a route for the proposed railway across the South Island and recommended the tunnels now in use on that railroad. In addition to being consulting engineer to the department of public works of New York City, Mr. Bogue was a member of the commission appointed by Mayor Strong to determine the feasibility of operating surface cars on Brooklyn Bridge. His advice was asked when a report was being prepared on the cost of a tunnel under the East River, New York City. He was consulting engineer to the Western Maryland and vice-president and chief engineer of the Western Pacific railroads, and also associated with the Canadian Pacific Railway. Mr. Bogue also made numerous reports on roads in foreign countries. At the time of his death he was a member of the board of direction of the American Society of Civil Engineers and a member of many other professional and social organizations.

Well-Known Consulting Engineer and Director of American Society Is Dead



VIRGIL GAY BOGUE